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i2M: Idea to Market

CULTIVATING INNOVATION: ASSISTIVE TECHNOLOGIES



In association with knowledge partner
Biotechnology Industry Research Assistance Council (BIRAC)
Department of Biotechnology, Government of India

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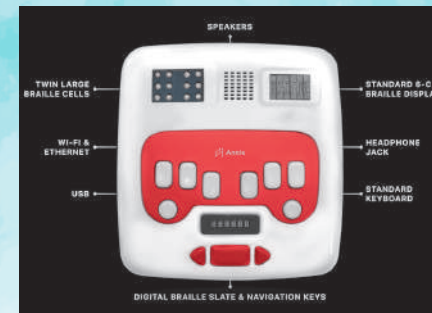
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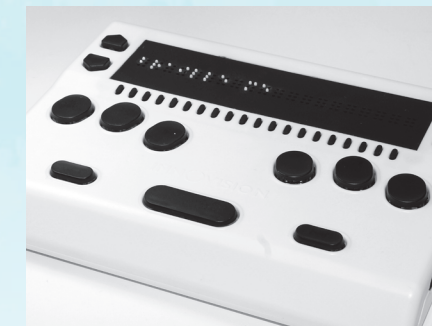
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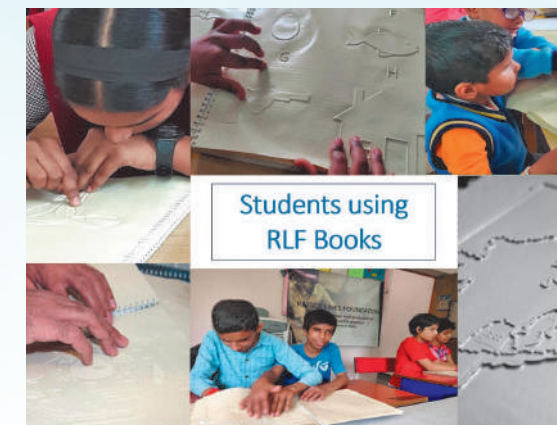
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Printed and published by
Vivify Media Pvt. Ltd.

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Liquid Chromatography

Leading LC, UHPLC
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Gas Chromatography

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and GC-MS/MS solutions



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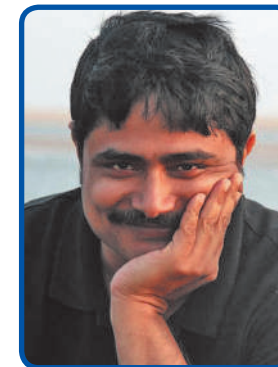
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Indian Assistive Tech Panorama within Eyeshot



As Indian manufacturers are jubilant over Prime Minister Narendra Modi's 'Vocal for Local' and 'Local for Global' mantra, it is an opportune moment to draw attention to Indian innovations in the assistive technology (AT) front.

A billion people, or 15 per cent of the world's population, experience some form of disability, and its prevalence is higher in developing countries, according to the World Bank. A fifth of the estimated global total—between 110 million and 190 million—experiences significant disabilities.

For decades, persons with disabilities (PWDs) in India have been dependent on imported products to help reduce their inconvenience and improve their life. The unavailability of affordable assistive devices and technologies, gaps in service delivery, discriminatory prejudice and social stigma have been big barriers to full social and economic inclusion of PwDs. Many physical environments and learning opportunities have remained inaccessible to them due to lack of appropriate and economical tools.

But with support and assistance from various government scientific establishments, several start-ups in India have in the last decade made forays into developing AT products to serve domestic consumers. In May 2009, the Department of Scientific and Industrial Research issued a notification that allowed scientists working in many government-funded research institutes to promote technology start-ups and for research institutions to hold equity in start-ups. This policy initiative led to the incubation of many technology start-ups in research institutes.

This publication profiles 17 start-ups that have developed AT products with funding and assistance from the **Biotechnology Industry Research Assistance Council (BIRAC)** under the Department of Biotechnology (DBT). A few of these start-ups are selling their products abroad as well. It also carries insights from key opinion leaders associated with the sector who offer a bird's eye view of the AT landscape in the country and discuss problems and potential solutions.

Fields like vision and hearing impairment, speech issues, autism, learning disabilities, prosthetic limbs, crutches and post-operative rehabilitation of breast cancer patients are covered.

We are immensely thankful to the team from our **Knowledge Partner BIRAC**, which includes Dr. Manish Diwan, Shilpy Kochhar and Rashmika Singh, for their assistance and valued guidance. We are also grateful to the key opinion leaders for their precious inputs.

We look forward to feedback and suggestions from readers to potentially plan similar endeavours in other technological streams.

Dipesh Kumar Satapathy
vmpl2016@gmail.com

Customised Wheelchair Ibex



Dhruv Chaudhry
Founder-CEO
Indent Designs Pvt. Ltd.,
Mumbai

Company

Established in February 2014, Indent Designs Private Limited (IDPL) was incubated at the Society for Innovation and Entrepreneurship (SINE) at the Indian Institute of Technology-Bombay. It operates in the electric personal mobility space. With inclusive design at the core of its design philosophy, it churns out products and services through frugal innovations. The company has filed six patents covering technologies for the automotive industry. In 2017, it explored opportunities in personal mobility space for the disabled and designed an electric mobility vehicle suited for Indian road conditions.

Product

There are many manual and powered wheelchairs available in the Indian market. Unfortunately, most of these are designed to navigate on smooth surfaces; and the ones designed for rough terrain are not usually indoor-friendly.

Our product Ibex is an electric personal mobility device designed to traverse on Indian road conditions. Its tadpole design—three wheels, with the front two being the driving wheels—and high torque ensure that it can reach where most personal mobility devices cannot. To make it durable, easily serviceable and low on maintenance, Ibex has been designed using ubiquitous, standardised cycle parts easily available in local markets. It can be easily modified to suit each user's need. However, no patent has been filed yet for this innovation.

Hindrances, tech challenges & sustainability

- As the sector meant for PwDs is a growing one, the product volumes are low, making it difficult to



manufacture products at such volumes. This problem grows further during the prototyping stage.

- Sectors like electric drive trains, power packs are just picking up, and due to this, the price of

assistive technology products are relatively high in India.

- There are many manufacturers across India for powered wheelchair. Most are either designed for indoor use or outdoor use, but

very few can manage both, especially while being portable. The market for such products in India is dominated by Chinese manufacturers and the cost of such products is always compared with cheaper Chinese counterparts.

AWARD

2nd rank at iPreneur event of Tata Institute of Social Sciences, Mumbai



BIRAC support

Funds are quite important for any start-up, and the funds provided by BIRAC arrived primarily during the lockdown last year, which immensely helped us.

Market reach, scale-up plans, strategy

We have sold 18 wheelchairs in seven cities. Assistive technology products always warrant government departments to be the biggest buyers and influencers to make those a success. Approaching NGOs, distributors and end customers is part of our strategy for better market penetration.

Stumbling blocks for promising new tech reaching users

- Right form of government support
- Red tape
- Lack of funds at the opportune time

Market access barriers

Awareness of end users and influencers about the existence of the product are major access barriers. Mentorship can reduce the existing disconnect between innovation centres and the workplace or end user. ■

Flexmo Crutches Mimic Human Foot



Arvind Suresh Ambalapuzha
Co-founder,
Flexomotiv Technologies Pvt. Ltd.,
New Delhi

Company

A production engineering graduate from Government Engineering College, Thrissur, I completed my Master's degree in mechanical design from IIT-Delhi. I met my co-founders Srinivas Adepu and Girish Yadav there. We started Flexmotiv in August 2017, when we started testing the crutch design Srinivas made with the help of our professors and doctors from AIIMS, New Delhi.

In the first half of 2018, we got incubated in IIT's incubation centre FITT and intensive research and development (R&D) work began. We kept iterating our designs, testing those with volunteer patients at AIIMS and nearby NGOs till we got a sellable design. The aim was to change the way mobility aid capitalisation is perceived and improve the quality of life of users through well-designed products and delivery mechanisms.

We received the BIRAC BIG Grant, which boosted our R&D efforts significantly, and we took a loan of ₹25

lakh from the Centre for Innovation Incubation & Entrepreneurship (CIIE) at the Indian Institute of Management, Ahmedabad, to start sales activities. Our crutches were launched on our 2nd Foundation Day. We sold our first batch of crutches and were about to scale up and then COVID-19 hit us bad. The market for crutches is still down, but once the COVID situation gets over, we are ready to scale.

Product

Flexmo crutches mimic human foot and can grip the surfaces better even if it is wet, sandy, muddy or rocky. A person can walk confidently without the fear of slipping and falling down. With the conventional crutches, people fall down often if they are not careful. So people tend to be slow and meticulous in where they put their crutches while walking. They always have to look down while walking. Apart from that, the regular crutches have cultivated a feeling of pity and we are trying to change that outlook by giving it a fresh look. We have one patent granted in India, one pending and two design registrations granted. We have filed the same patent in the United States and other countries as well.

Benefit

Users can walk anywhere, anytime using our crutches. With a traditional crutch, the inability to use on uneven surface prevents that independence. These dig inside the sand on a beach, making it hard to walk with, and thus any crutch user will need another person to hold him. Our design makes it easy to walk on the sand or any other terrain.

Whether addresses a void

It addresses a void and is also a step ahead of earlier designs. Functionally, we improved on the existing crutches by giving it an all-terrain feature, but also we filled in the void that assistive devices are insipid and gave them vibrance to boost confidence.



Hindrances

People's taboos regarding disability, their feeling of pity and their lack of awareness on how it should be mitigated are the big hindrances. People still think they need financial assistance and free assistive devices because they are disabled. They do not believe that the correct assistive device can help them alleviate their differences. This is a major factor for sales. Also, the metrics which many NGOs track is the number of assistive devices distributed as opposed to people who are properly rehabilitated.

Sustainability & cost-effectiveness

We focussed on making the crutches a valuable friend to PwDs, going beyond a simple aluminium rod. Therefore, it is priced higher than what is currently available in the Indian market, but is still a fraction of the cost of innovative crutches found in the United States and Europe. Our pricing is still affordable and sustainable enough for our company to grow and create more such products.

BIRAC support

The mere selection of our design for BIRAC's BIG Grant offered us the confidence to take the product ahead. Apart from the money, BIRAC helped us connect with many industry stakeholders and gave us a lot of opportunity to present our product to the world. They also offered ad-hoc assistance through First Hub meetings.

Market reach & penetration strategy

We are selling through distributors and hospitals in Hyderabad, Bangalore,



Delhi-NCR and Chennai, and via Amazon and Seniority across India. We have not started much marketing efforts and we are looking for investment to scale it up. Our strategy now in the COVID-19 situation is to promote online and create awareness about our product's advantage among orthopaedics and physiotherapists. As assistive devices are a niche and fragmented market, for scaling up and deeper market penetration, apart from monetary investment, holistic partnership between start-ups and other gatekeepers of the community is needed.

Addressing disconnect between innovation centres & end user

Innovation centres should walk the talk. Many offer webinar and master classes on various topics. But those are repetitive and not so productive. They should instead invest time

in actually sitting with the start-ups and helping them figure out if their solution is viable in a scalable and sustainable way by auditing their plans.

Stumbling blocks stopping new tech from reaching users

Fear of change and prioritising entertainment than quality of life is a key factor. People are willing to spend money on new and fast mobile phones to watch videos and browse social media, but are not willing to spend half that price in getting something that improves their life. Penetration of Facebook is huge even in remote villages, but awareness of properly using a crutch is not. Secondly, government policies are again aimed at faster Internet, not better knowledge and awareness. This also is a reason why a new technology fails to reach users. We give

him more of what he wants, not what he needs.

Plans to develop other assistive tech products

We do have plans to make a full range of mobility aid. We are now expanding our verticals to elderly care as well. Till October 2020, we engaged in R&D for other products, scrapping all the help we could from Villgro and Social Alpha.

Barriers to market access for assistive tech products

A fragmented market and lack of awareness among disabled people about assistive technology and its benefits are the big barriers. Subsidy and free distribution is only for products with lowest cost, not for products with good value for money. Low interest from angel investors and venture capitalists is also a barrier. ■

AWARDS

One of the winners
of NCPEDP-Mphasis
Universal Design
Awards 2020

India Design Mark
Award 2020

Leader in Innovation,
Royal Academy of
Engineering





Dr. Pooja Mukul, MD

Director,
Jaipur Foot Organisation—
Bhagwan Mahaveer Viklang Sahayata Samiti (BMVSS)

Director,
Enable Foundation for Persons with Special Needs

A Rehabilitation Physician and locomotor disability consultant, Dr. Pooja Mukul is a US India Science & Technology Endowment Fund and Wellcome Trust awardee for affordable healthcare. In partnership with the Massachusetts Institute of Technology, and Stanford, Strathclyde, DeMontfort and Santa Clara universities, she has been working on developing high-performance, appropriate and affordable assistive devices with the vision 'All may walk'.

Perspective on Indian assistive tech landscape; sector's evolution, potential

The present assistive technology landscape in India is inefficacious. The needs are predominantly unmet. In the last few years, research and innovation in this space have gained momentum. However, a lot of it is misdirected and maladroitness. We are yet to see indigenous products commercialized and being used on the ground.

It is hard to predict how we will be placed after five years. However, if multidisciplinary teams including engineers, doctors and end users work with greater engagement, I don't see why we cannot turn over a new leaf.

Suggestions for early-stage tech start-ups developing solutions for PwDs

Recognising a need is the basis of all design and time spent absorbing its intricacies and complexities is time well spent. Early-stage start-ups may have brilliant ideas, but this is a niche domain, and therefore, they should seek mentors with insight in this space and use them as sounding boards.

Research should be immersive, and start-up professionals should move out of their labs, spend time with doctors, end users and service providers, be coherent with their needs and wants so as to match technology

to people and not retrofit people to technology.

They need to decide if they are innovating or imitating and be upfront about it. Although affordability has to be weaved in when designing for low-resource settings, their work should be driven by quality and not cost.

They must know that the journey is long, there are no shortcuts, so the timeline should be realistic.

Policies or support system available for start-ups working for PwDs

Most success stories are based around the idea of being in the right place at the right time. For start-ups, that place is India and the time is now! The present government is committed to ensuring that all policy is geared to foster a culture of innovation and support entrepreneurship across the spectrum. The onus now is on the start-ups to make the vision of 'Start up India, Stand up India' a reality.

Reason behind relatively limited number of assistive tech innovators

It is a non-mainstream sector. Most engineers are oblivious of this domain. The end users are largely from the bottom of the economic pyramid, and hence, not high on anyone's priority list. To draw attention to this area, engineering institutes

should proactively expose and sensitize students to socially relevant research fields.

Bottlenecks to creating sustainable demand & market access

Our approach to disability is that of patronage and not empowerment, which by itself, is a major bottleneck. Most work is done under a charity model; hence the usual market forces of consumer-based supply and demand do not exist. The users are disenfranchised and become passive recipients of handouts rather than entitled consumers. As a consequence, the customer is not the consumer and donors/NGOs act as surrogate customers.

As most devices are provided free, no matter how low the start-ups price their products, they will always have to compete with 'free'. Therefore, unless their products offer substantial functional edge and are still cost-effective, they are not likely to find takers. Even after that they may need to channel the device through NGOs or government agencies.

Creation of sustainable assistive tech business by start-ups

It is ironic that a sector where user needs are predominantly un-served should impose immense challenges to entrants. The system being followed over decades views disability and the need of assistive devices in a paradigm of a medical or humanitarian crisis in need of immediate

management rather than creating a sustainable model.

Tens of thousands of devices are handed out in camps each year. Although it is tempting to follow this route of instant gratification, without sustainable programs these sporadic achievements are nullified. That explains why we have not made any meaningful headway yet.

To have a sustainable business, start-ups need to team up with the government, non-governmental agencies, get insurance companies to cover devices or CSR funds to subsidize them.

According to the World Health Organisation's last report on disability, 80 per cent of the world's disabled live in the low- and middle-income countries and only 5-15 per cent of them have access to assistive devices. There is a huge market waiting to be tapped outside the country. The start-ups should 'Make in India' for application across the world.

It may seem out of context, but I must add that treatment without prevention is simply unsustainable. It will be worthwhile for start-ups to direct some attention to innovating for prevention of disabilities as well.

Ways to promote domestic & international risk capital for assistive tech sector

What we now have is 'philanthro-capitalism'—engaging in philanthropy

the way business is conducted, and 'venturephilanthropy'—impact investment where philanthropic goals are achieved.

Investors are aligning investment goals with values that go beyond simple financial element. On that count, I would imagine rehabilitation to be a good investment as it builds human capital, converting resource burners to resource earners.

I think investors can play a transformative role in the overall outlook to disability. They are investing for social impact and measuring social impact is a challenge. It takes money, time, imagination and creativity, but as they are the ones spending the money, it would only be wise to assess outcomes and impact. From being number-driven, they can redirect the sector to being impact-driven.

How can start-ups collaborate with NGOs?

NGOs are the prime players in this sector. The distribution of devices as part of government initiatives is also largely channeled through NGOs.

Working in tandem would be a win-win situation for both NGOs and start-ups. NGOs are not geared for any enhancement of design or technology that they distribute. With a start-up as a partner, they can upgrade their technology, improve their product or introduce newer

designs. The start-up, on the other hand, gets a platform for trials as well as direct access to the market being served by the NGO.

Successful business models/policies/financial support system in mature markets that can be replicated in India

In mature markets assistive devices are an integral part of healthcare. They are either provided through the healthcare system or covered by insurance. A case should be made for the same in India.

Suggestions to raise the reach of assistive tech products

Awareness needs to be augmented across healthcare providers and end users about the need as well as availability of services. There is a huge shortfall of well-trained medical and paramedical workers in all streams of rehabilitation, which should be addressed, as it is critical for scaling any programme. Rehabilitation services should be integrated in mainstream healthcare and also de-centralized, so that they are located where they are needed the most.

There is also an urgent need to improve disability statistics. Available data is unreliable and without that, we are running blind and unsure of scale. We need robust data for shaping policy, making informed decisions, assessing need gaps, outcomes and impact. ■

Platform for Autism Screening & Therapy



Manu Kohli
CEO, SM Learning Skills Academy for Special Needs Pvt. Ltd. (CogniAble), Gurgaon

Company

I am an engineering and management professional focused on developing affordable, accessible and data-driven detection and therapy solutions for autism spectrum disorder. I and my wife Swati Kohli are founders of CogniAble, a technology platform driven by artificial intelligence (AI), offering innovative early screening and therapy services for children with autism spectrum disorder (ASD).

In 2016, my wife started her own therapy centre for autistic children in Gurgaon. The development of CogniAble began in 2018 in collaboration with Dr. Prathosh AP, chief of engineering, and Dr. Joshua Pritchard, clinical mentor and USA territory manager. Our team consists of 22 members.

Over the past couple of years, we have formed several alliances. Our research partners include IIT-Delhi, Maulana Azad Medical College, Safdarjung Hospital and Tata Trusts. Social Alpha and Fortis Mental Health Group are our go-to-market partners.

Problem statement

The following limitations prevalent in the special needs' healthcare market warrant the development of

auto-progressive, data-driven, technology-based solutions:

- **Lack of early detection & intervention:** The Indian Academy of Paediatrics (IAP) officially recommends screening of all children for autism using standardised autism screening tools between 18-24 months of age. In addition to a prevalent lack of awareness about autism, most children are diagnosed late by a year or two due to limited clinicians and infrastructure. Delay in detection subsequently delays the start of early intervention therapies at a crucial time when the neuroplasticity of children's brains is at a peak, depriving them of the development of necessary inclusion skills. With 50,000 children born in India every day, it is not humanly possible to screen children in that large a number.
- **Expensive healthcare services:** The diagnostic and treatment services currently available are concentrated in few selected cities, burdening parents emotionally and financially due to both relocation and treatment affordability challenges. These services are also not covered under insurance. Behavioural treatment may cost more than ₹30,000-50,000 per month for a family, usually lasting many years.
- **Lack of accessibility:** Available clinical services are majorly concentrated in metropolitan cities and scarce across most other parts of the nation. In case of those parents who can afford it but don't reside close to a therapy centre, a long commute of two to four times a week can be cumbersome and detrimental.
- **Lack of experts:** Limited mental health clinicians are available in India for diagnosis and therapy, struggling to serve the ever-increasing population of children with autism.
- **Human bias:** There is an immense lack of data-driven approaches among therapy providers. Treatment is majorly lead by individual judgment and solely dependent on their individual skills.

Extent of problem in India

India has over 15 million individuals with autism and is adding 270,000 new cases each year. With limited awareness and clinicians available, many children are diagnosed harmfully late. Delay in detection subsequently delays early intervention therapy necessary for children's key skill development that promotes their societal inclusion.

Early intervention in first five years of child's life can ensure development of IQ by 10-15 points, skill acquisition in multiple areas promoting inclusion in school & society. Current treatment quality is not optimum, and treatment plans lack customisation for the child. There is an urgent need for of solution that leverages technology to scale up the services with four major objectives—affordable services, use by non-experts, accessible remotely and is data-driven.

There are certain common problems faced by all the stakeholders affected by the growing issue of autism, especially in India. They have no digital tool to offer patients a data-backed solution.

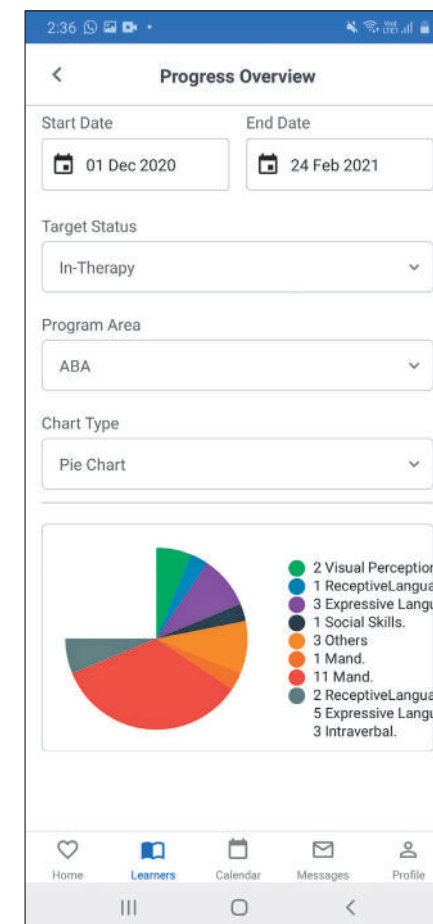
Product & service

We have two sub-divisions:

Autism screening: Following a structured video script provided by us, any clinical expert or non-expert can use a mobile phone to record a 5-10-minute long video, showing their guided play-based interaction with the concerned child aged between 1.5 and 5 from his home or clinic.

After he submits this video on our mobile app, it is uploaded on our cloud platform and automatically analysed by our unique AI models that provide screening results to the user by predicting the child's risk of autism with minimal waiting time. The complete process happens at 10 per cent of the current general market cost and zero user travel. This innovation is in advanced validation stage.

Interim validation study results of our models (with 250 subjects) have

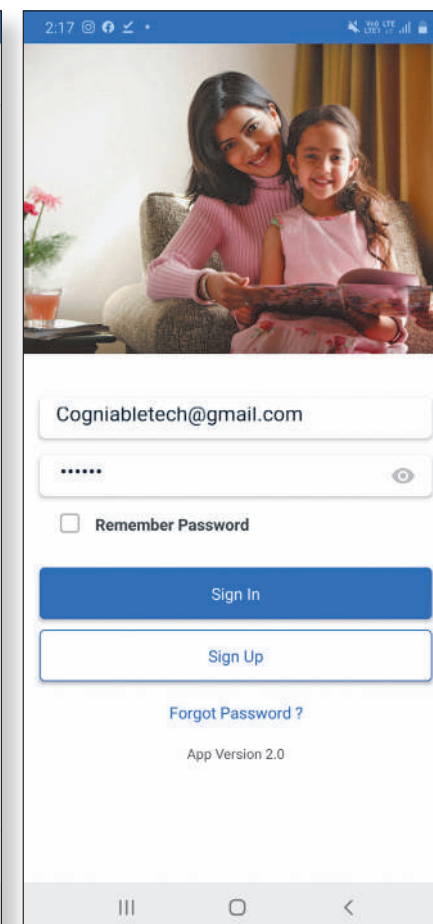


shown very encouraging scores. We expect to complete clinical trials in the next six months along with a market-ready product.

Autism therapy: Our digital therapy platform is available on mobile apps (iOS & Android), empowering users to have a relevant integrated assessment and treatment plan at 10-20 per cent of market price. It can be used by clinicians, schools, parents and any non-expert, who is a part of an autistic child's regular support system to avail customised therapy plans automatically populated with play-based teaching methods and training videos.

The mobile app comes with 40 hours of training resources. The curriculum involves skill-building in 21 domains like language, behaviour, academics, classroom and social skills. Each target to be achieved under a skill includes detailed teaching pedagogy and video modelling tutorials so that non-experts can gain the necessary knowhow to manage the concerned child's condition. Users can simply record the child's status and progress data in the app, then analyse those by machine learning models to customise their treatment.

This therapy tool and its resources can be accessed remotely by anyone



from any place. Its use brings a significant change in self-dependency and skills of autistic children at the right time in young age. The product is already market-ready, is deployed with seven clinics and more than 120 users both in and abroad.

The tool offers individualised treatment plans for each child and enables parents, schools and clinicians of children to congregate on a common platform, thereby improving information symmetry. The tool has been developed using advanced patented machine language technology in collaboration with leading Indian technology and medical institutions. We have filed two patents for our innovations.

Benefits

CogniAble's digital screening and therapy services promote inclusivity in society by enabling timely and high IQ development, skill acquisition in multiple areas, such as social, academic, speech and language skills, in autistic children. It encourages self-dependence amongst such children.

With services offered in many languages, we also aim to combine our screening platform with scheduled vaccination checks for children

AWARDS

Awarded at the 2020 Responsible AI for Social Empowerment (RAISE) event, organised by the Ministry of Electronics and Information Technology and NITI Aayog.

A winner of Pitch event of NTT Data's Open Innovation Contest in healthcare category

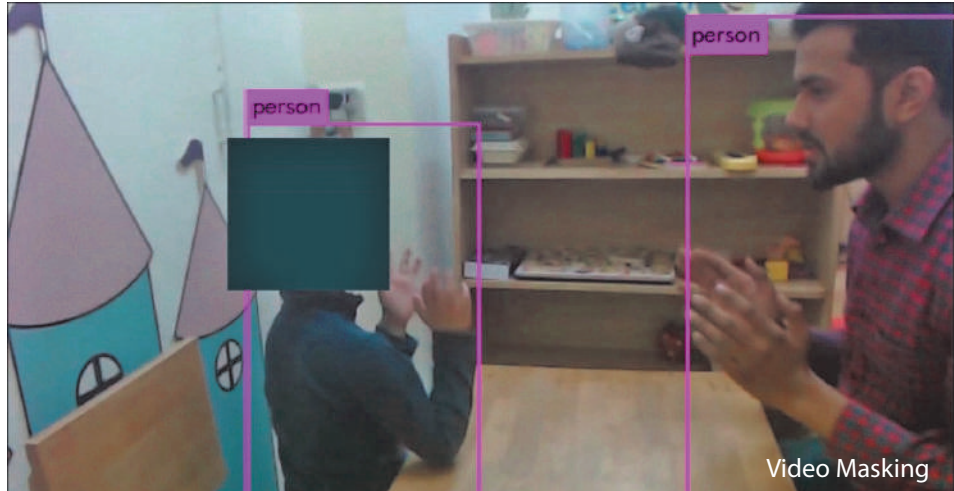
covered under the government's Universal Immunization Programme for widespread access to all. It also helps doctors held back by limited resources regarding time and money for running a brick & mortar clinic. Our solution will raise the quality of care, improve income generation, revenue and prevent patient dropouts.

Whether addresses a void

Our product addresses a void in the Indian and global market. There are no similar digital solutions in operation within India. Moreover, the solutions available abroad are also different from CogniAble.

Hindrances & tech challenges

- **Inertia to adoption of technology in this sector:** Despite the physical mode being expensive, inherent bias towards traditional physical therapy is present among end users.
- **Lack of data:** Machine learning (ML) models need a large amount of data for precise automatic therapy recommendations. For ML optimisation, a large number of active users should be available on the app. We are tying up with institutions to gather more data.



- **User retention:** Average dropout rate is 15-20 per cent in the initial stage.
- **Language barriers:** Availability of application, content, training videos in multiple languages can fast-track adoption, but that is a challenge. We are in the process of translating our interface and content into these languages.

Sustainability & cost-effectiveness

The price for the screening platform is ₹300-500 per use. Our treatment platform is available for B2B customers as a mobile app at a monthly subscription cost of ₹800 per month for each learner. For B2C customers, our price is at around ₹3,500 as it includes four to six personalised sessions with experts for assessment, programme creation, revision and explanation.

While our screening platform will mostly be available as a single-use product per user, as autism rates are increasing at an alarming rate and the child birth rates in India are one of the highest, universal mass screening of each child in India using CogniAble even once will ensure product longevity and sustainability. As autism is a chronic condition, the utilisation and repeat usage of our therapy platform will ensure a very high lifetime value as the product can be used usage for several years.

Rivals

- **Traditional:** Therapy centres run by the government, NGOs, pediatricians, rehab professionals and hospital—all belonging to a fragmented market.
- **Digital:** No such digital solution for ASD and other developmental disorders exists in India. The solutions available in the United States are COGNOA, focused only on

ASD detection; Central Reach and Gemini, but none use AI or ML.

BIRAC support

BIRAC's support has helped us in product development as well as testing the efficacy of the pilot.

Commercialisation, market penetration, strategy

Our screening tool is in advanced clinical trial stage and the therapy tool is in the implementation- early scaling stage.

For deeper market penetration, we require translation of platforms into vernacular languages, wider awareness of autism and other developmental disorders, and collaboration with various government and medical institutions.

Our strategy to approach target markets are:

- **B2B clients:** Building relationships and collaborating with ABA therapy clinics and hospitals that have mental and behavioural health departments, special needs schools, independent therapists, paediatricians and special education practitioners.
- **B2G:** Approaching government departments working for PwDs, public healthcare centres and hospitals.
- **B2C:** Spreading awareness about autism and CogniAble amongst parents and families with autistic children.

Our priority product positioning is B2B or B2B2C. We plan to forge such alliances. We have also tied up with Tata Trusts to launch a community-based drive in Uttar Pradesh's Gorakhpur district and plan to do more such tie-ups in future.

Addressing disconnect between innovation centres & workplace

- Through proven efficacy via clinical trials and promising results, and developing public confidence in innovations.
- Widely sharing user experiences by early adopters and influencers.
- Support and guidance from relevant government departments and medical institutions.
- Designing training programmes that address key skill gaps throughout the supply chain.

Stumbling blocks stopping a promising technology from reaching users

- Lack of right market access, clinical trials, right approach for market acceptance (resistance to change), skilled labour and other resources needed to adopt technology.
- Lack of awareness around the benefits of technology and doubts about the return on investment from adoption.
- Questions on privacy and data security.

Other assistive tech being developed

Our team plans to further develop and expand the existing digital product to include the management of learning disabilities in its portfolio within the next 6-12 months as well.

Supply chain & distribution of assistive tech products & services in India

These are still at a nascent stage in India. The general expectation for such innovations is that they belong to the not-for-profit segment and the public perception to the business of AT products is not very favourable in the country. Limited sales and distribution partners lead to difficulty in creating physical linkages and providing after sales services. Limited funds are available in the ecosystem, which attracts a smaller number of innovators, institutes and venture capitalists.

Financial support available for PwDs or start-ups working for PwDs

Such support is available, but those are not sufficient to comfortably support PwDs throughout their lifespans. Meanwhile, government funding for start-ups working for PwDs has increased in the last several years through grants, competitions and other initiatives. Focus and investment by the government on digital mental health solutions will drive product adoption in our field. ■



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NAAC ACCREDITED 'A' GRADE INSTITUTION



EXPLORE, INNOVATE, IMPROVISE and ATTAIN YOUR DREAMS!

DEPARTMENT OF BIOTECHNOLOGY

B.Tech Biotechnology

M.Tech Biotechnology

M.Sc Biotechnology



- Biotechnology is growing at a fast pace in India and is rapidly gaining significance and opportunities throughout the world. This sector in India is highly innovative and is on a strong growth trajectory. Robust growth in Biotech industry has attracted the significant amount of attention.
- At Manav Rachna International Institute of Research and Studies (MRIIRS), the Department of Biotechnology, since its inception in 2002, has given due focus to innovation and incubation of ideas, in its scientific space, where all biological and non-biological domains converge to provide much needed solutions for better Life.
- Intensive academic input and research has enhanced expertise and skill of faculty members and students as evident from numerous

publications, research projects, collaborative projects, consultancy, national and international competitions and collaborations.

- Excellent Placements for students with all its graduating batches in reputed industries and institutions.
- Students with good and meritorious academic record are being selected for higher education based on GRE/TOFEL/IELTS/GATE etc within and outside the country.
- Established Ph.D Programme has many research scholars who have undertaken varied research work for their study and are working in the well-furnished and equipped Labs.

INNOVATION AND INCUBATION

- ✓ In the recent years there has been a heartwarming paradigm shift of demographics in the Indian corporate landscape and the country has witnessed a titanic surge in the number of women entering the economic wave.
- ✓ **M/s Tricho Agronica Pvt Ltd**, Department of Biotechnology, FET, MRIIRS is the Start-Up company that has all women team members as stake holders ie: Dr. Sarita Sachdeva, Dr. Nidhi Didwania, Dr. Abhilasha Shourie, Ms. Deepti Sadana.
- ✓ The Start-Up has received a grant **Indian Oil Startup Scheme (IOSUS)**, a "Start-up India" initiative of Ministry of Petroleum, GoI that aims to support innovative ideas that have significant business potential, social relevance and/or are focused on environment-protection.
- ✓ A bio formulation product '**Bio elixir**' which is a remedy for bull's eye pathogen at low cost has been developed and has patented. The synergistic effect of the bio elixir constituents has the capability to increase systemic resistance in plants by increasing photosynthesis process in plants. It is the bio fertilizer and a bio fungicide organic formulation.

- ✓ A team of enthusiastic research minds from the Department of Biotechnology had represented the University in an international level competition iGEM 2020 (International Genetically Engineered Machines) organised by MIT, USA on 15 th November 2020 and Won a Bronze Medal. It was sponsored by DBT, GoI, India on winning **INDIAN BIOLOGICAL ENGINEERING COMPETITION or iBEC**.

- ✓ The team comprised of ten students from Department of Biotechnology viz., **Kartik Jatwani, Devashish, Abhilash Pandey, Alok Tanwar, Shivam Bhardwaj, Shivani Khare, Umra Mahmood, Srishti Chopra, Tarini Vohra and Hardik Grover** and two students from Department of Computer Science **Japneet Singh and Chandershekhar**. The team was mentored by **Dr. Kapila Kumar, Assistant Professor**, Department of Biotechnology, MRIIRS.

- ✓ The Team created a proof of concept of an environmental biosensing solution by the name of **Li-Koff** which is a bio-sensing solution which detects and degrades **Nitrosamines** using synthetic biology.

MRIIRS Campus: Sector-43, Delhi-Surajkund Road, Faridabad,
E-mail: admissions@manavrachna.edu.in Ph: 0129-4198100/4198600

FOR ENQUIRIES CONTACT
0129-4259000

ScreenPlay for Autistic Kids



Shiv Kumar
Co-founder and
Head-Business Operations
Kidaura Innovations Pvt. Ltd.,
Nashik

Company

As a computer engineer, I always had an inclination towards working and creating impact in the field of child-care and education. While graduating, I met Paras Sharma, a computer science graduate and a co-founder of this company who was also exploring ways to develop data-driven solutions for social good. Around January 2018, we started working on the problem statement: How can we improve the lives of children with autism by using digital technology in Digital Impact Square (DISQ), a TCS Foundation initiative. By July that year, we developed our first prototype of ScreenPlay with DISQ support and mentorship and tested on more than 900 children in Nashik pre-schools. And with time we also started work on providing therapies related to autism and developed another product Communicaa. We are at present engaged in pilot testing Communicaa with Symbiosis International School and Manipal College of health Professions.

Problem statement

Autism spectrum disorder (ASD) is a childhood neuro-developmental

disorder. It is a challenge for someone with little or no expertise to distinguish an autistic child amongst typically developing children. It is usually missed or mistaken as delayed developmental milestones or slow learners. This delay in identification causes the child to miss out on the golden period (3-6 years) of development and growth, crucial in maximising the positive impact of early intervention and therapies as the brain is more adaptable at a younger age. Once children get identified with autism, then providing cost-effective therapies is again a big challenge due to less number of experts in the field.

Intensity of problem

Prevalence of autism in India is one in 100, whereas in developed countries, the prevalence rate is one in 59. The total number of children with autism in the age group of 0-14 years is around 5 million in our country and providing support to such a huge number is a challenging task.

Product

ScreenPlay consists of a set of tablet-based games that assesses a

child's ability. Using games helps us in capturing the true nature of the child without letting the child know that he is being assessed. Moreover, through our technology, we can record every minute details that naked can't even comprehend. Additionally, AI lets us extract and analyze patterns in the child's gameplay which helps in predicting the potential risk of autism and other related disabilities. Through our product, we can achieve the same goal of identification of potential risks using fun, productive, data-driven and scalable way. We have filled a provisional patent for the product.

Whether product addresses a void

Most tools and application available in the market today are based on a questionnaire directly dependent on human observation and often human biases create some major errors. But in our product, we can identify the same potential risks in funny, productive, data-driven and scalable manner.

Hindrances & tech challenges

Access to autism data set was the biggest challenge we faced during development.

Cost

Our one-time screening cost is around ₹500, and our product related to providing assistance in therapies will also cost around ₹500 per month.

AWARDS

One of the winners of NCPEDP-Mphasis
Universal Design Awards 2020

One of the winners of 'Innovate for an
Accessible India', a NASSCOM Foundation
and Microsoft India initiative in partnership
with DST and Ministry of Social Justice and
Empowerment

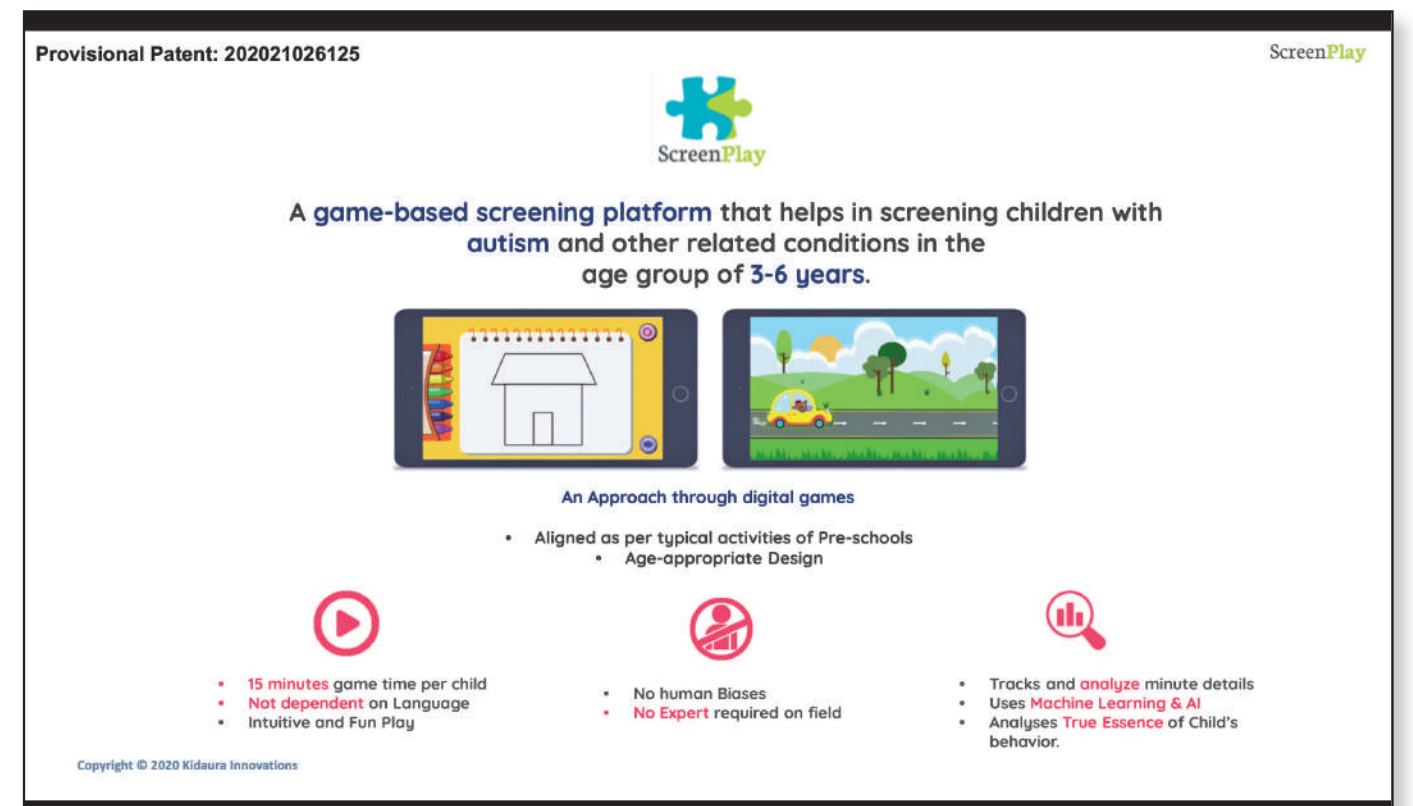
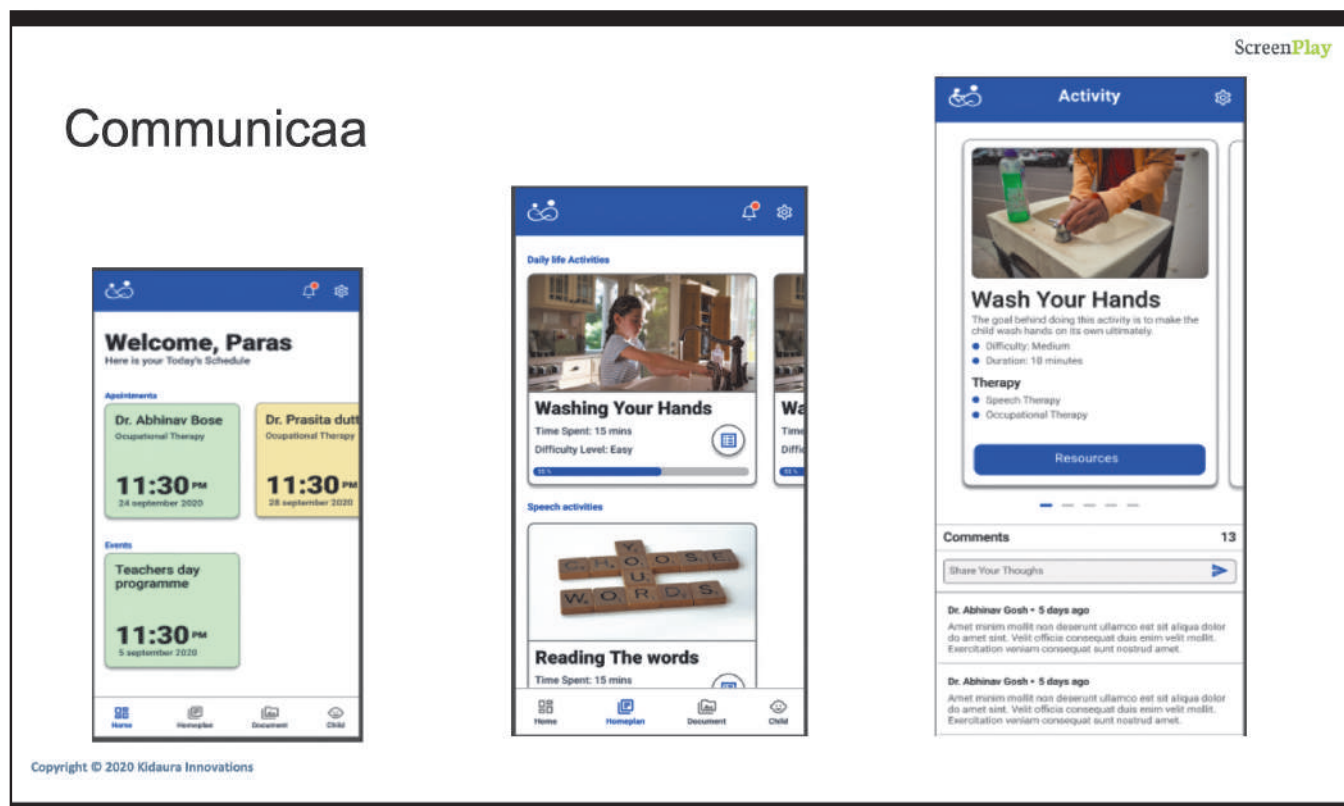
BIRAC support

BIRAC is supporting us in conducting clinical trials of ScreenPlay.

Plans to develop other assistive tech products

We are developing a platform named Communicaa, which helps therapy

centres and special schools to provide assistance to parents in home-reinforcement of therapies. Also have a product called AuraConnect, a screening tool for developmental challenges and aims to solve parents' initial doubts on a child's overall growth and development. ■





Prof. Rishikesh T Krishnan

Director,
Indian Institute of Management, Bangalore

An expert in strategy and innovation, Prof. Rishikesh T Krishnan has authored two books on innovation: *From Jugaad to Systematic Innovation: The Challenge for India*, and *8 Steps to Innovation: Going from Jugaad to Excellence* (co-authored with Vinay Dabholkar). He held the Jamuna Raghavan Chair in Entrepreneurship at IIMB from 2007 to 2010.

Perspective on Indian assistive tech landscape; sector's evolution, potential

There has been interest in assistive technology development in India for a long time, but until recently, it was largely restricted to academia, with dozens of students working on such technologies for their undergraduate engineering projects. The big shift observed in the recent past is that this development has become more commercially-oriented as reflected in start-ups, incubators and accelerators devoted to assistive technologies. If this enthusiasm is properly channelised, India has the potential to be a world leader in such technologies.

Suggestions for early-stage tech start-ups developing solutions for PwDs

Start-ups need to immerse themselves in the lives of PwDs and with the activities of non-governmental organisations working with such people so that they identify and understand the right problems to solve. Starting with a user perspective is critical to coming up with genuinely path-breaking solutions.

How can start-ups collaborate with NGOs?

NGOs have deep knowledge of the problems faced by PwDs. Start-ups should partner with NGOs having expertise in the relevant disability from a very early stage of problem and need identification. They should not see NGOs only

from a distribution or market access perspective.

Policies or support system available for start-ups working for PwDs

Overall, government policy towards start-ups is quite favourable. While there may be some generic issues that government needs to address regarding start-up funding and taxation of Indian venture funds, these are not specific to start-ups working for PwDs.

As far as the assistive technology space is concerned, the government can go a step further by supporting the creation of appropriate standards, as well as helping through procurement and distribution of products and AT devices. Testing and validation is an important part of developing such technologies, and therefore, the government can support the creation of relevant testing facilities at incubators.

Reason behind relatively limited number of assistive tech innovators

A big challenge is to find viable business models to succeed in this space. We don't have any prominent examples of successful assistive technology start-ups so far. There are few investors focused on this space. These are the barriers that need to be overcome.

Bottlenecks to creating sustainable demand & market access

There are challenges in need identification, affordability, identifying viable

business models, regulatory standards and distribution.

Creation of sustainable assistive tech business by start-ups

The government could play an important role by being an intermediary in the certification, procurement and distribution process. Business-to-government-to-consumer (B2G2C) is a more likely model than business-to-consumer (B2C). Start-ups need to ensure that the products they design solve relevant problems in an easy-to-use way; that the products are reliable and affordable; and that the product can be easily manufactured.

Ways to promote domestic & international risk capital for assistive tech sector

With India having a large number of persons with disability, the Indian market has the potential of scale, but lack of affordability makes it difficult to get the advantage of this scale. Products have to be priced very competitively so that diffusion is possible. International markets may be a way to diffuse the costs of development. It is difficult to foresee traditional venture capital getting excited about this sector.

Suggestions to raise the reach of assistive tech products

Make sure you are solving a relevant problem in a way that improves the quality of life of a well-identified segment of PwDs with a well-aligned and affordable solution. ■



DSS R&D

DSS Imagetech Pvt Ltd, a biotechnology company with offices all over India providing cutting-edge solutions to researchers and clinicians in various fields of Life Sciences and Healthcare. DSS Imagetech is recognized for its expertise in Microscopy, Clinical Diagnostics, Medical Equipment and R&D.

With a DSIR recognized R&D centre, DSS is constantly innovating to create marketable products & technologies in India in the field of Lifesciences & Biotechnology. Some of the company's R&D initiatives are as follows:-

• Cervsure

DSS brings a total solution for Cervical Cancer from Collection → Extraction → Detection → Genotyping.



• Food Testing Kit

DSS started its foray into the molecular/DNA based food testing business a few years back and has now created a large product line to address the Food and Dairy markets in India. We are in process of launching GMO testing kit.



• CT-NG

Developed in collaboration with Dr B.R. Ambedkar Center for Biomedical Research (ACBR) under the University of Delhi.



Braille Literacy Device 'Annie'



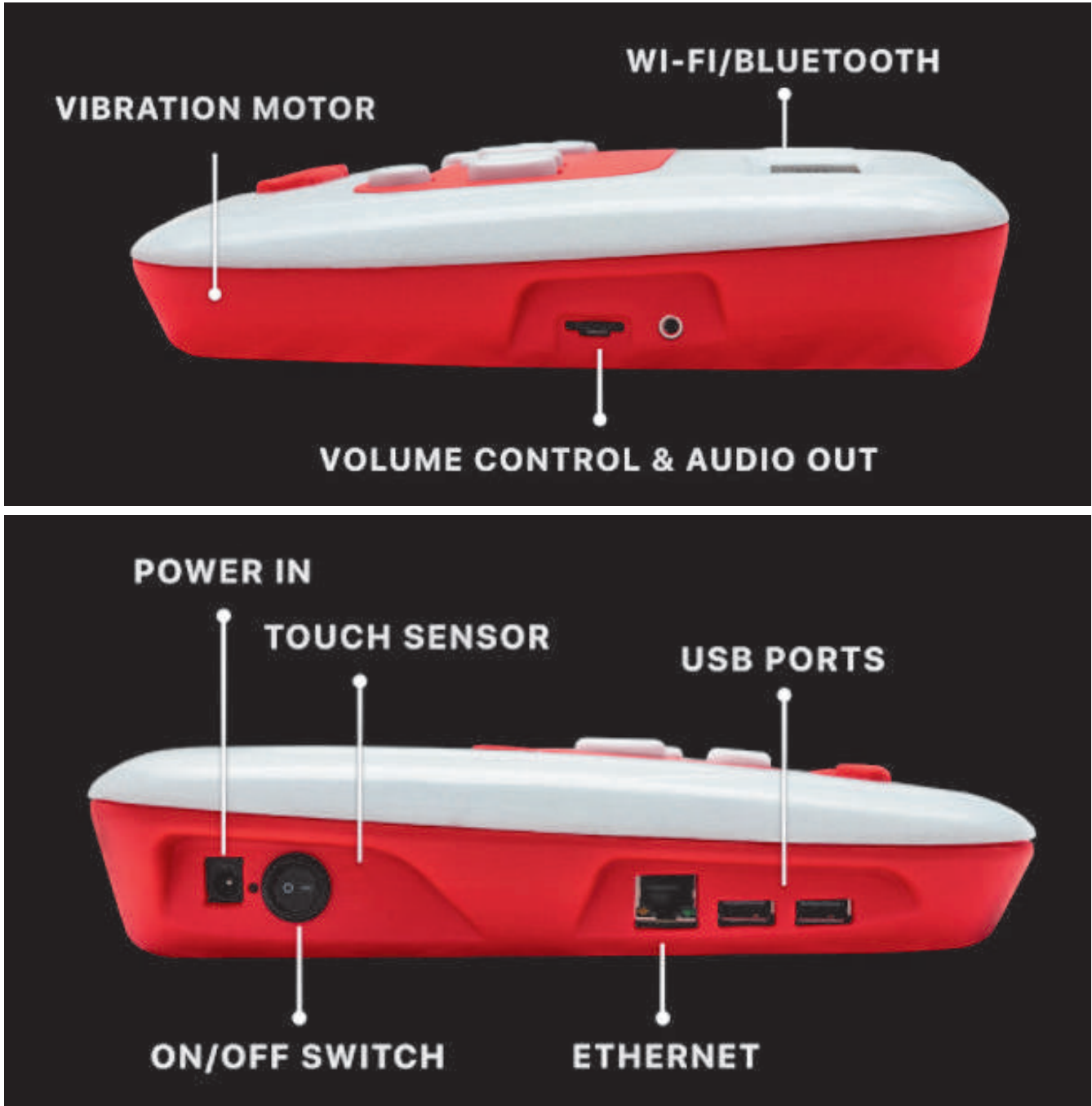
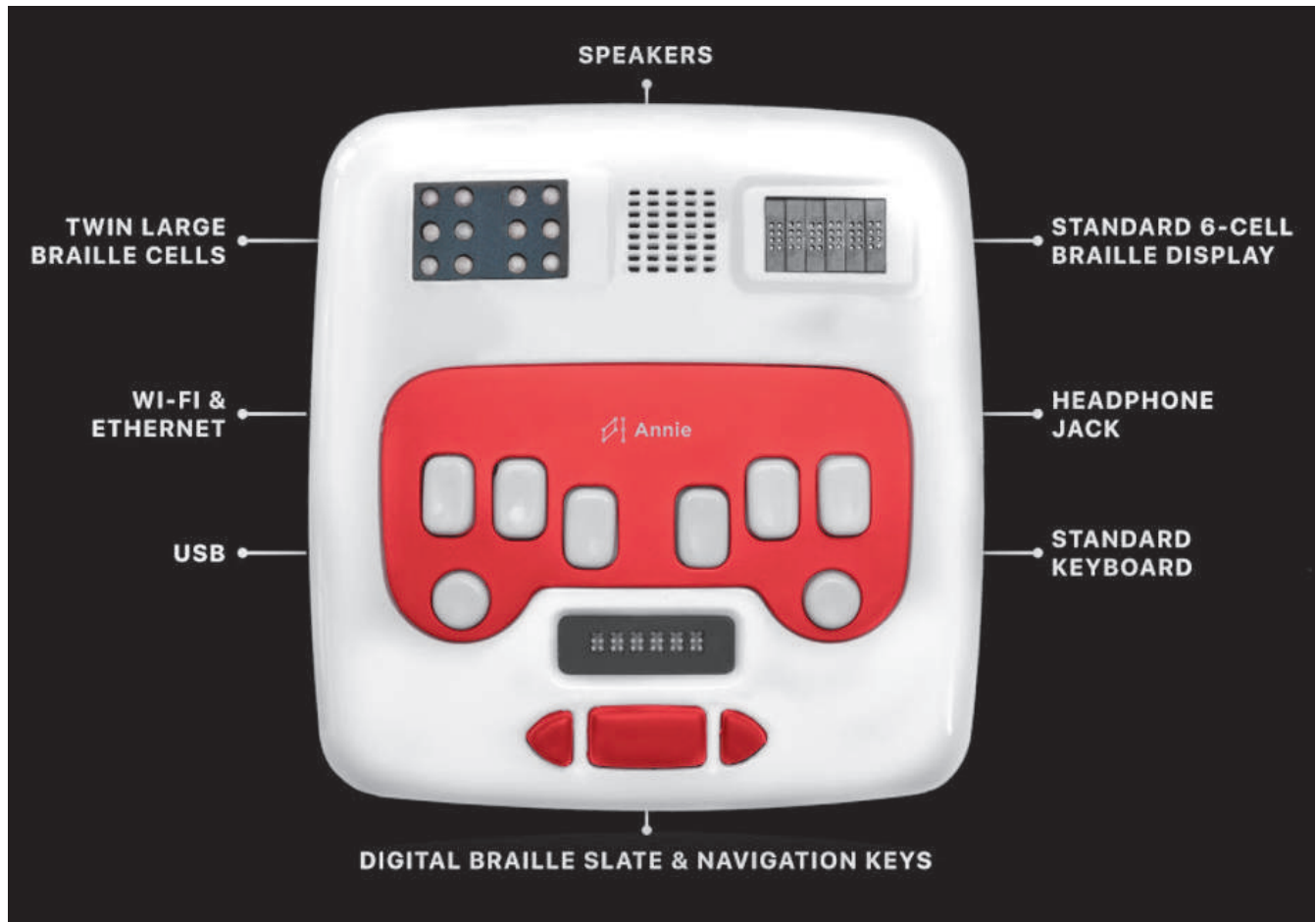
Sanskriti Dawle
CEO & Co-Founder
Thinkerbell Labs, Bengaluru

Company
We make education more inclusive by building Braille learning technology for visually impaired students. In 2014, I and co-founder Aman Shrivastava, then students at the Goa campus of the Birla Institute of Technology and Science (BITS) Pilani, designed a dicta-teacher to help learn the Braille alphabet.

We first launched India's first Braille Smart Class Solution in Ranchi, and that received praise from Prime Minister Narendra Modi. Our team has expertise across multiple disciplines like sales, marketing, software development, supply chain management, manufacturing, electronics, and mechanical and industrial design. This has allowed us to design and manufacture customised hardware on a large scale and distribute across the country and abroad.

Product
Annie, the world's first Braille literacy device, helps the visually impaired learn to read, write and type on their own through interactive audio-guided content. It is a patent-pending device that has all hardware modules tailored to teach Braille, along with interactive content designed by curriculum experts and teachers. Annie allows easy monitoring and evaluation of student progress via Helios (analytics) and downloading of new content by seamlessly integrating with the ecosystem. It also allows scheduling of tests and lessons and enables teachers to give homework.

It gives instantaneous feedback for mistakes and continuously evaluates the user, making the learning experience engaging and retentive. It introduced the world's first digital Braille games in single player, multiplayer modes,



challenges, lessons and exercises to bring in a collaborative and smart classroom learning experience.

Our digital Braille writing slate has been granted a provisional patent, and Annie's patent is pending. Annie and Annie Smart Classes are now available across more than 40 schools and centres in India, the United Kingdom and the United Arab Emirates.

Vision & impact
The social impact created will help millions of visually impaired children become literate, thereby beginning their education and paving the way to employment and independence. Impact created include increase in Braille literacy, rise in employability;

better and more employment opportunities and reduce dependence on family members or the government.

Reinvigorated interest for learning would increase word of mouth publicity and schools may witness more enrollment of visually impaired students. Our long-term vision is to deploy connected hardware products that can deliver interactive educational content to visually impaired students anywhere in the world.

Whether addresses a void
Braille literacy rates across the globe are abysmally low—less than 10 per cent in the United States, less than 4 per cent in the United Kingdom and less than 1 per cent in India. India has

the most visually impaired people in the world. The total annual economic burden due to visually impaired in India is estimated at \$77 billion of which \$22 billion is due to child blindness.

The current primary education tools include wooden blocks, marbles and plastic slates, with continuous 1:1 teacher supervision. The lack of special educators, insufficient science, technology, engineering and mathematics (STEM) content in Braille and lack of general awareness has contributed to unemployment and inefficient rehabilitation of the visually impaired. Our product improves the efficiency of Braille learning; and that is essential as there is a high correlation between Braille literacy

and employment among the visually impaired.

Hindrances & tech challenges

Braille technologies have inherent challenges in both design and manufacturing, owing to the compact size and repeated use. Schools in remote areas have weak or no Internet for a connected learning experience, and this is currently being addressed by local servers and OTA connections. To deliver complex learning outcomes to young children with little to no knowledge of even the script that they would be using on Annie was a product design (hardware and software) challenge that we continue to improve upon by working with users and experts and coming up with innovations to test and release.

Sustainability & cost-effectiveness

For 20 students, a smart class will typically cost ₹9 lakhs, thus amortising the cost per student per year to less than ₹10,000 over a period of three years. To put this cost in perspective, the government has a scheme called Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances (ADIP), which gives around ₹15,000 per year for every visually impaired person to procure a gadget of choice. The price of Annie is well within special educational needs (SEN) budgets in other countries.

Qualified teachers of the visually impaired (QTVIs) are the only direct competition to Annie, but there is an acute shortage of them all over the world. This leads to a need to achieve more learning outcomes by the same budgets and human resources.

Annie enables one QTVI to teach and monitor multiple students at the same time, proving to be a productivity boost for them instead of a threat. There are other Braille products by other assistive tech market leaders like Perkins and Humanware that are substitutes for Annie, but require human intervention, are not smart/connected, assume literacy of Braille or are prohibitively expensive (BrailleNote Touch by Humanware is \$5,495 and Perkins Smart Brailier is \$2,195).

BIRAC support

We could develop a new business model for Annie Smart Classes due to the subsidies received from BIRAC and Social Alpha.

RECOGNITION

Dehradun-based National Institute for the Empowerment of Persons with Visual Disabilities (NIEPVD) has certified Annie as an effective Braille teaching device.

Recognised for best practices in Braille learning by South Wales Sensory Service (UK). Recognised for best practices in Braille learning by South Wales Sensory Service (UK).



Market reach & penetration strategy

To scale up and achieve our goal of cent per cent Braille literacy, reaching the needy is critical as the visually impaired population is sparse and not necessarily enrolled in blind schools. We work closely with government schools, inclusive schools, the social welfare organisations, district commissioners and CSR units for sponsorship. As blind schools and other institutions are easily reachable and funding is available, we are trying to increase the teaching capacity and efficiency of these schools with Annie Smart Classes.

To reach the ones outside of institutions, we are trying innovative business models and distribution networks, such as partnerships with government block resource centres and cluster resource centres, as well as private resource centres to create mini Annie Smart Classes, which would cater to a group of students in an area.

Addressing disconnect between innovation centres & workplace

This disconnect can be tackled by hosting conferences that bring innovation centres, end users and workplaces; building user groups for all categories of organisations so that the former make it easier to reach potential users and also create a platform for them to share their stories among themselves.

Stumbling blocks to a promising technology reaching users

- Access to capital for product design, testing, iteration
- Lack of user groups and communities, making it harder to reach users and test and iterate
- Lack of technology awareness among users
- Absence of large distributors in developing countries makes sales efforts tougher for start-ups
- Financial barriers to carry out testing and design development

BrailleMe Tablet



Shyam Shah
Co-founder and CEO
Innovision
(Inceptor Technologies Pvt. Ltd.), Thane

Company

I started Innovision in 2015 with Surabi Srivastava. During my last year of B. Tech course at IIT-Bombay, I interacted with a few visually impaired students. They introduced

me to Braille and explained the literacy crisis. I wondered if we could build a device like Kindle in Braille for such students. With that idea, I started making a prototype and showcasing it to organisations working with the visually impaired. They showed a lot of interest, and therefore, I continued work and after graduating started Innovision.

Product

BrailleMe is an inexpensive Braille tablet that essentially allows the visually impaired to access applications like MS Office, e-books, social media and other readable documents in Braille, giving them access to information they didn't have before. Its USP is its low cost—a fifth of that of other competitive devices, and multilingual support. It supports 20 languages.

The gadget has been tested rigorously in harsh conditions like dust, humidity and heat. Its body is reinforced from inside to survive accidental drops by users. We have received two US patents as well. It is a complete replacement for Braille books used by the visually impaired and opens new opportunities for digital jobs.

Whether addressed a void

There was no such product available in developing countries and BrailleMe is trying to fill that void.

Hindrances & tech challenges

The main challenge has been in manufacturing and research & development (R&D). The product involves 4,000 small components. Developing a manufacturing and supply chain plan for it was the biggest challenge.

BIRAC support

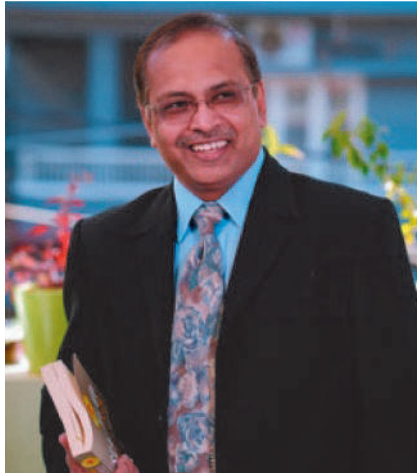
BIRAC provided us a R&D grant to and helped us set up a manufacturing unit.

Market reach, strategy

The product is available in 12 countries. We plan to increase our penetration in these countries. The company has distributors in Malaysia, South Africa, Kenya, the United States, France, the United Kingdom and Turkey.

As a product like this has the potential as a global need, we have had an international plan from the beginning. We offer the device through organisations working for the visually impaired and government bodies. ■





Dipesh Sutariya

Co-founder and CEO, Enable India
Philanthropist

Trained computer scientist Dipesh Sutariya's non-profit organisation has been working for the independence and dignity of PwDs since 1999. He was the Indian Social Entrepreneur of the Year in 2019 and a Schwab Fellow in 2020.

Perspective on Indian assistive tech landscape; sector's evolution, potential

With the focus on innovation in the country, there has also been a surge in the assistive technology space. It is very heartening to see youth coming forward to provide solutions for removing barriers for the persons with disability.

Suggestions for early-stage tech start-ups developing solutions for PwDs

First of all, hats off to all the entrepreneurs who want to make a change and go that extra mile to make a difference. It is important to keep the problem in the centre in developing a simple solution. Changing the narrative to 'assistive solution' rather than 'assistive technology' will help focus on the problem. Enjoy the journey for finding the right solution; there will be pressure on proving the scale, but focus on the solution first rather than the scale.

Policies or support system available for start-ups working for PwDs

There are multiple incubators, accelerators and start-up hubs that have come up in the space of assistive technology, and have been doing wonderful work. I think none of these policies or support systems are focusing on the problem at the centre. For example, a visually impaired person once told me he loved to swim, but could not swim in a straight line and would either hit the wall on one side or collide with another swimmer. He inquired whether there was any assistive solution to help him.

I would like to find if any solution exist for this problem and are there any start-ups working to address this. We have conceptualised a platform for catalysing assistive solutions for PwDs, and would love to see if the

government can provide a platform for all assistive technology start-ups to connect.

Reason behind relatively limited number of assistive tech innovators

The biggest challenge here is the supply-demand mismatch. Assistive technology start-ups find it difficult to access the market and PwDs do not have easy access to the right solutions. PwDs are also not aware of their specific needs. This gap can be managed by creating a platform and marketing it.

Bottlenecks to creating sustainable demand & market access

There is still an awareness gap among PwDs on the possibilities of overcoming barriers with the use of assistive solutions. Also due to diversity in disability, this makes it a bit complex. There are 21 disabilities and in every specific type, there is a spectrum of functional needs. Spreading awareness is the key to removing this bottleneck.

Enable India has an interactive voice response (IVR) platform—Enable Vaani, Hamaari Vaani (Hindi) and Namma Vaani (Kannada). We have been spreading awareness via this platform to reach those who are yet to be sensitised, but this needs to be scaled at the national level in other languages. If government can adopt Vaani and make it Divyaang Vaani, it can serve as one of the platforms for managing some of the bottlenecks.

Creation of sustainable assistive tech business by start-ups

There is a huge need to create a platform for market access, but meanwhile, mainstreaming assistive technology would be one of the ways to sustain. The vibrate mode was first introduced as a feature in mobile phones for persons with hearing

impairment and now is used by all. I believe there is always a huge potential of assistive solutions to make life easier for all.

Ways to promote domestic & international risk capital for assistive tech sector

I see investments in assistive technologies going up, which is great. One suggestion would be to target the mission or behavioural change as the goal and not revenue.

How can start-ups collaborate with NGOs?

User-centered design is the core for assistive solutions. Start-ups will benefit by partnering with NGOs for market access. The business case should be: How the accessibility issue of users is resolved?

Successful business models/policies/financial support system in mature markets that can be replicated

I think the financial support given to persons with disability in various countries like the United Kingdom, the United States and Australia can be looked at. I am particularly impressed with the National Disability Insurance Scheme (NDIS) model of Australia, where the start-up and the ecosystem players also have a role to play.

Suggestions to raise the reach of assistive tech products

A platform for catalysing assistive solutions for PwDs, a platform for spreading awareness like the Divyaang Vaani and a financing scheme like Australia's NDIS are some such suggestions. It would be a great vision to create reach and market access for the last mile. In India, the limit for assistive technology under the Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances (ADIP) scheme should be increased. ■



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We at OnTime always believe in ...

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Our prime focus is on the deliverables as per the customer's requirement. We make sure to follow GDP guidelines and ensure compliance.

WE STRIVE TO MAINTAIN THE
INTEGRITY
OF THE **SHIPMENT**
THROUGHOUT THE
TRANSPORTATION
PROCESS

Our services:

- BioPharm & Pharma Logistics support
- R&D Institutions logistics support
- Pre-Clinical logistics support
- Clinical Trial logistics support
- RLD sourcing support
- Central Lab logistics support
- Temperature control logistics support
- Direct to patient logistics support
- Commercial supply chain logistics support.
- Dangerous goods logistics support

QUALITY

TRUST

SERVICE



BEST SOLUTION



AT BEST PRICE



WITH BEST SERVICE



OnTime Globe Kyarrier Pvt. Ltd.

66/A, Allpack, Ground Floor, Marol Cooperative Industrial Estate Road, Marol Naka, Andheri (East), Mumbai - 400 059.

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Stamurai: Speech Therapy App for Stammering



Meet Singh
Co-founder,
Demosthenes Technologies Pvt. Ltd.,
New Delhi



Anshul Agarwal



Harsh Tyagi

Daily Training Plans



Company

The company was co-founded by me, Anshul Agarwal and Harsh Tyagi, all graduates of the Indian Institute of Technology Delhi. We all have previous start-up experience. Anshul was a founding team member at Curofy, a doctor's networking app that recently got acquired. While I and Harsh were founding team members at Mistery, a men's wellness company. And two of us stutter.

Around three years ago, I was helping Anshul with his speech when we came up with the idea that we could codify the entire experience, making speech therapy accessible and affordable. That is when Stamurai began.

Product

Stamurai is a speech therapy app for stammering. Current solutions for this are expensive, costing around \$5,000; prone to relapse, with 80 per cent relapse rates; and inaccessible in developing countries like India. Stamurai addresses this by automating speech therapy.

The app has instructional videos to teach speech therapy exercises and tools to help practice those exercises. The app also acts like a self-help group with purpose-to-practice (P2P) features and support. Stamurai is currently available on Android and has users across 149 countries.

Vision & Impact

- **Improving the quality of life:** People who stutter are considered less employable, often bullied and frequently anxious and fearful.

Providing quality therapy helps alleviate most of these conditions.

- **Increase access to speech therapy:** India has a severe shortage of therapists. Stamurai provides speech therapy access to anyone with a smartphone.
- **Reducing costs:** Current speech therapy solutions cost ₹40,000 in developing countries. Stamurai is available at 5 per cent of this. Our pricing is ₹1,200 per year in developing countries and ₹7,100 per year in developed countries.
- **Improving outcomes:** Traditional speech therapy has an 80 per cent relapse rate. With Stamurai, the digital coach is always available, hence decreasing chances of relapse.

Whether addressed a void

Ours is a new product. Digital therapy tools for stuttering are rare and Stamurai is miles ahead of competition. There are no rivals in the Indian market at present.

Hindrances & tech challenges

Lack of funding options in the initial stages was a big challenge along with getting connected with clinical providers.

BIRAC support

BIRAC helped us with funds for a clinical trial—extremely important for a healthcare product. Apart from that, the BIRAC brand lends credibility to Stamurai.

Market reach & penetration strategy

The Stamurai app is live on both Google Play Store and Apple App Store, and has seen over 40,000 installations across 155 countries (16,000 in India). We have generated \$40,000 in revenue over the past 12 months.

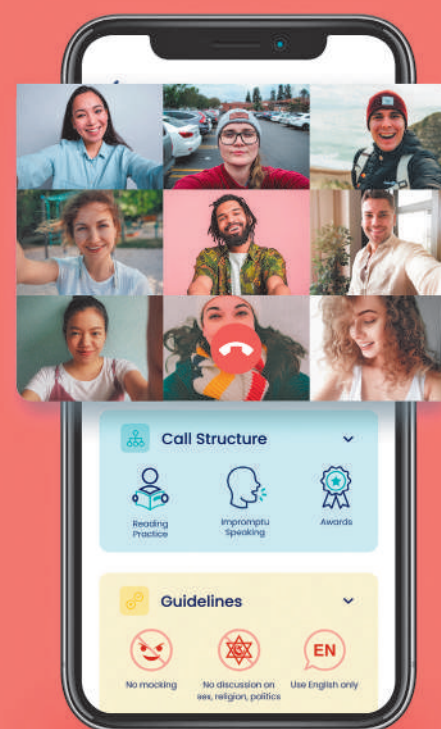
Scaling up will require addition of new languages, moving to different speech disorders.

Our go-to-market has been largely organic through search engine optimization and content marketing. We plan to develop partnerships with paediatricians and self-help groups for stuttering.

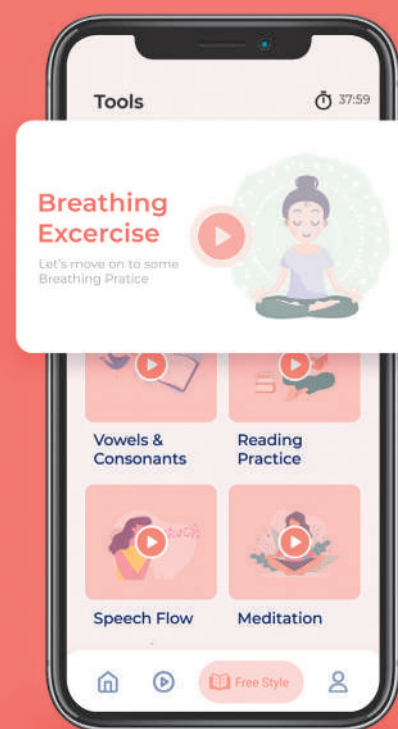
Addressing disconnect between innovation centres & workplace

- Application processes could be made easier and less time-consuming for founders

Group Video Calls



Breathing Exercises, Meditation, DAF and much more...



- Reporting requirements can be reduced

Stumbling blocks to a promising technology reaching users

- The market is nascent in many industries. CSR funds can be made more easily available to make assistive technology reach those who need that at affordable prices.

- The government can purchase the products and subsidise those for end users.

Plans for other assistive tech products

We do plan to add very soon support for other speech disorders like cluttering and language disorders in the app.

Barriers to market access for assistive tech products

- **Nascent market:** Paying capacity of India customers low
- Lack of funding options for assistive technology start-ups

AWARD

Won 3rd position
in Prosus Social
Impact Challenge
for Accessibility
2020



Aum Voice Prosthesis

Dr. (Prof) U S Vishal Rao

Head neck surgical oncologist & robotic surgeon
Director, Innaumation Medical Devices Pvt. Ltd.
Bengaluru



Company

Innaumation Medical Devices Pvt. Ltd. is a Bengaluru-based medical devices start-up, working in voice restoration of throat cancer patients and has developed the Aum voice prosthesis. It all started when a throat cancer patient from Chikkaballapur, a small town in Karnataka, came to me for treatment. His surgery was over and his voice box was removed. His primary concern was how to speak again. He said he could not afford the voice prosthesis, as it cost up to ₹30,000.

This visit was followed by an interaction with a friend, Shashank Mahesh, co-inventor of this prosthesis. As I shared this problem with him and

expressed my desire to help the patient through donations to procure the prosthesis. He replied: "Why don't you develop an affordable device? I can help you with the industrial expertise and you provide the medical inputs." This was the beginning of the development of Aum.

Product

The Aum Voice Prosthesis, an affordable voice prosthesis for throat cancer patients, is a 'one size fits all' device that allows the patient to speak even in the absence of a larynx. The partial shutter relatively opens when the air is exhaled from the lungs and allows the air to pass through from the second end to the first end of the cylinder. This mechanism also prevents the entry of food particles into the second end, thus preventing fungal infection in the prosthesis and extending the life span of the product.

The presence of rings in the prosthesis helps prevent the piston effect, thus increasing the life span of the prosthesis in the patients. Made from platinum-cured medical-grade silicone, it costs ₹8,000 compared to devices from competitors that cost ₹30,000-45,000. Secondary insertion can be done in an OPD and not in an operation theatre. It comes with an accessories kit containing a Stoma bib, a cleaning brush, gelatin capsules and the Sushrutha inserter, custom made by a toy maker from Karnataka. We also have a surgeon's kit specially made to insert the prosthesis into patients' throat. Seven patents have been filed for the prosthesis and its accessories.

Target groups

Our target customers are patients who have lost their voice due to laryngectomy. Voice prostheses

available in the market cost between \$450 and \$700 and these also need a replacement every six to eight months. As most of our throat cancer patients hail from poor backgrounds, they cannot afford the expensive voice prosthesis available in the market.

Our affordable prosthesis is offered free to patients who cannot afford it through the Aum Foundation and the Ayushman Bharat Scheme, as we believe that 'Speech is a right and not a privilege'. Through our efforts, laryngectomy is now recognised as a handicap under section 2 of the Rights of Persons with Disabilities Act. Under the Aum Foundation, we are also helping patients to avail disability certificates. The device is also sold at its selling price to patients who can afford it.

Whether addressed a product void

Ours is not a new invention. Our competitors, Provox and Blominger, were already in the market. But these products are relatively expensive. We have initiated setting up Lary Clubs in hospitals so that patients can interact among themselves and overcome problems

and challenges that they are facing by getting help and support from fellow patients.

Hindrances & tech challenges

Changing regulatory norms during the period created a need to restructure the financial planning and timelines. Then following clinical studies, we had to make minor amendments to the design. At this juncture, it was technically complex to change the moulds. Changing moulds without altering intellectual property while still complying with regulatory norms was a major hurdle.

BIRAC support

BIRAC has supported us in terms of exposure through the Startup Estonia exhibition, which offered us the recognition needed. It also funded us. We received the BIRAC Biotechnology Ignition Grant (BIG), which was helpful in developing the product and setting up the initial manufacturing facility. Its Product Commercialization Programme (PCP) fund helped us initiate sales and set up a manufacturing facility with US Federal Drug Administration and the European Union's CE marking standards.

Commercialisation stage, strategy to scale up

Our device is in the early traction stage. We have been reaching out to regional cancer centres and government and private hospitals through a distributor. Our device is a doctor-driven product; hence we have been approaching various head and neck oncologists across the country.

Plans for other assistive tech products

We are developing a hands-free version of the device, through which the patient need not apply pressure on the throat using his hands to speak.

Barriers to market access for assistive tech products

Regulatory approvals and lack of a robust sales and distribution network are the key barriers.

Tactic to reduce disconnect between innovation centres, workplace/end user

1. **Academia-industry collaboration with focus on medical colleges and institutes:** There is a need to assist and encourage the medical

AWARD

National Start-Up
Award 2020 in
the healthcare
category at Startup
India event



fraternity to take up entrepreneurial roles. The day-to-day, recurring issues at public health centres, clinics or bedside need the support of the Atal Incubation Mission and Atal Tinkering Labs, which must be housed inside the medical institute premises, and not restricted to engineering or non-health sectors alone. This could greatly conserve the time for clinical partnership and accelerate innovation.

2. We need idea to proof of concept (PoC) funding budgets at the point of care with defined deliverables supported by a medical university to help bridge academia and industry disconnect. The Rajiv Gandhi University of Health Sciences in Bangalore, a state university with 700 institutions, recently conducted a Hackathon inaugurated by Prime Minister Narendra Modi. This programme was launched in partnership with the Indian Institute of Science, Bangalore, a few other institutes and the ministries of information technology and biotechnology. Such endeavours will enhance and co-develop a shared eco system. ■



Prateek Madhav

Co-founder & CEO,
AssisTech Foundation (ATF)

Madhav's AssisTech Foundation (www.atflabs.org) is India's first ecosystem focused on assistive technology that supports and promotes innovative disability technology start-ups. Since its inception, ATF's goal has been to create more awareness about the world of disability and bring about a positive impact through the start-ups it nurtures. In a span of two years, ATF has had an impact on the lives of 1.75 lakh PwDs through its programmes and initiatives. In its Accelerator programme, ATF has a portfolio of 21 start-ups, with more than 50 AT products and 19 patents.

Perspective on Indian assistive tech landscape; sector's evolution, potential

The assistive technology ecosystem is fragmented. The government has decent policies and programmes on disability but is not aware of AT start-ups and technology. AT start-ups are struggling; challenges include funding, distribution and lack of specific AT-specific policies. PwD beneficiaries have nil or limited access to and awareness about innovation in AT space. Around two billion people will need at least an AT product by 2030 and only one in 10 people in need have access to assistive products, according to the World Health Organisation.

Suggestions for early-stage tech start-ups developing solutions for PwDs

The journey from being an innovator to entrepreneur is long. One needs to work on skill and talent of founders and involve PwDs right from the inception and design phase. Start-ups need to build a network of NGOs, tech partners, angels and universities. They should think big but work on specific use cases in a phased manner. They should think beyond technology and explore marketing, sales and distribution as well.

Policies or support system available for start-ups working for PwDs

The Indian government has launched a number of initiatives related for start-ups and that is quite encouraging. However, sectors like assistive technology need

specific focus. We need to have government direct procurement policies for AT start-ups and launch special debt funding schemes for such start-ups. Disability departments of each state should be mandated to embrace new technology from such start-ups.

Reason behind relatively limited number of assistive tech innovators

Disability and assistive technology is still looked at through the lens of charity. Awareness about AT is low. There are no coordinated initiative from the government in the AT sector. ATF is creating India's first assistive technology centre of excellence (AT-CoE), which will encourage innovation and nurture start-ups through positive partnerships.

Bottlenecks to creating sustainable demand & market access

Seventy per cent of PwDs in India live in rural areas. Traditional channels—government, NGOs, etc—have not worked effectively. So there is a need to explore newer models like micro entrepreneurship.

Creation of sustainable assistive tech business by start-ups

That can be done through business model innovation. Business-to-consumer (B2C) may not work in many cases in AT, and therefore, focus on business-to-business (B2B) or business-to-business-to-consumer (B2B2C) may be needed. There is also a need to focus on different use case where start-ups can monetize, for example, selling their AT solutions

to universities for their students with disabilities.

Ways to promote domestic & international risk capital for assistive tech sector

We need patient capital in the AT start-up sector. There are some angels, but not many venture capitalists are interested in AT despite the return on investment of 1:9, according to AT2020 report. AT is not included by even most of the impact investors. Perception and awareness are the main issues.

How can start-ups collaborate with NGOs?

NGOs are critical stakeholders in disability and assistive technology. Most of the AT start-ups already engage NGOs for product validation, pilot testing and distribution.

Successful business models/policies/financial support system in mature markets that can be replicated in India

A major difference is that in some countries, the cost of AT is included in insurance. Also the government does direct procurement of AT solutions from start-ups. These may be emulated.

Suggestions to raise the reach of assistive tech products

Suggestions for that include positive partnerships and government policies like direct procurement from start-ups. At our AT-CoE, we are building world's first alliance with representatives from seven countries who are interested in AT innovation and start-ups. ■

Addressing the unmet global need for assistive technology

Assistive technology (AT) enables people to live healthy, productive, independent, and dignified lives, and to participate in education, the labour market and civic life. AT reduces the need for formal health and support services, long-term care and the work of caregivers. Today, only 1 in 10 people in need have access to AT due to high costs and a lack of awareness, availability, trained personnel, policy, and financing.

At KIIT-TBI, our startups are developing affordable AT solutions with support from Biotechnology Ignition Grant (BIG) of DBT-BIRAC, Govt.

“

Innovation is the only fix to the rising societal challenges around us.

Achyuta Samanta
Founder KIIT & KISS



Sahayatha a smart locomotory device with novel inbuilt defecation assembly.

Dhanvantri Biomedical

Sruthi Babu
Founder
Dhanvantri Biomedical Pvt Ltd

Pooja kumari Jha
Founder
Swayogya Rehab Solutions Pvt Ltd

Mi-knee an non-invasive system for healing articular cartilage in the treatment of osteoarthritis.

Subrata Kr Halder
Founder
Halder Rehab Pvt Ltd

MoSeat an innovative postural correction chair for children with Cerebral Palsy

Saurabh Agrawal
Founder
Neukelp Innovation Technology Pvt Ltd

Neukelp is an AI-powered posture training and monitoring device that sticks to the centre of your upper back with the help of an adhesive. This intelligent posture training device can't help but vibrate every time you slouch to remind you to pull your shoulders.

Mrutyunjay Suar
CEO, KIIT-TBI

It's happening now in Odisha. Startups are rising and shining here and building next generation products in the area of assistive technologies with support from BIG scheme of BIRAC, DBT, Govt of India

KIIT-Technology Business Incubator (KIIT-TBI) started in 2009 as an initiative of KIIT with the generous support of Department of Science & Technology (DST), Govt. of India, aims to offer a conducive ecosystem to promote the innovation capacity of the startups/ SMEs. So far 230+ startups are incubated, from which 50+ are women led and 120+ in the biotech sector.

KIIT-TBI is marching ahead, promoting innovations and entrepreneurship in the country with centres like BRTC-BIRAC Regional Centre, SFURTI, Women Technology Parks, NIDHI Centre of Excellence, Technology Transfer Office. KIIT-TBI is supported by various bodies like DST, MeitY, MSME, DBT-BIRAC, DIT, TDB, MoFPI, DFID Startup Odisha, Invest India and may others.

Reach us: biotbi@kiitincubator.in

Learning Aid for CwDs



Saloni Mehta
Founder-CEO
Tactopus Learning Solutions Pvt. Ltd.,
Bengaluru

Company

What started as an idea to solve the issue of equal access to learning for all, led us down a path of doing our masters design project at the IDC School of Design, IIT Bombay, on the subject. There was a drive to take our innovative solutions to the people who needed them, and that took us on this entrepreneurial journey. This is how the idea of creating inclusive learning aids for children came into being through the usage of multi-sensory, tech-enabled products that can be used by all, irrespective of disability.

Tactopus is an edTech platform that provides young children with developmental delays the opportunity for long-term, one-on-one interactions online with specialists, who assist them and their parents in resolving speech, behaviour and learning issues, connecting special educators, parents and students digitally. We also provide children with special needs with customised learning aid and resources required to make e-learning successful.

Problem statement

When you think of educational resources for children, there are

enough options. Children with disabilities (CwDs) have different learning needs, and they need aid that can respond to those differences and make the classroom truly inclusive.

Also, as education goes digital, we continue to systematically exclude these children. This severely hampers their growth, higher education, employment and community integration, all because of the lack of adequate focus and appropriate resources that cater and respond to their special needs.

Intensity of problem

One in every six children has a learning disorder or a developmental delay. However mild or severe may be these symptoms, it makes specialised intervention a genuine global need. This is an estimated \$45-billion market opportunity globally and a \$5.9-billion addressable market in urban India alone.

Products

To address the gap in appropriate learning aid, we initially created multi-sensory alternatives for use in Pre-K to grade 3 classrooms. For example, children with vision loss cannot access printed pictures, drawings. Our books with tactile graphics make it possible for them to read the images with their fingertips. Augmented with audio explanations and sound effects from our phone app, appreciation is enriched for the child.

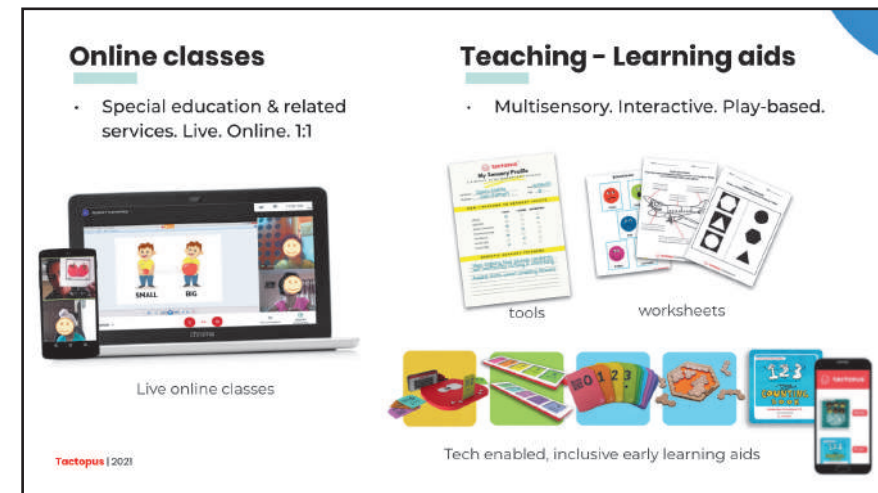
Children with attention deficit hyperactivity disorder (ADHD) often find it difficult to focus on a task for extended periods. Our tactile flashcards engage children in a blind-folded game for learning mathematics. Tactile learners find it easier to stay focused with this approach and achieve learning goals more effectively.

Bridging the physical and digital, we develop products, including textured, tactile books, flashcards, games, puzzles and a mobile app that uses image processing to augment audio interactions and games onto the books and cards. When touch, sound and vision

come together, it makes for great and accelerated learning experiences for all children, irrespective of disability. What's more, when children with different abilities share products, they are enabled to learn on a level-playing field as equals.

edTech platforms these days mostly cater solely to children who are in the top 60 per cent of their classes. We are focusing on the bottom 40 per cent who do not benefit from the one-to-many model, but need personalised interactions tailored to their special needs. Existing solutions for these children are limited to their physical surroundings, and usually, deal with a lack of quality human and learning resources. Our solutions are continuous, adaptive to every child's ability and progress, dependable, individualised, convenient, extensive, scientific with data-driven progress tracking and inclusive.

During the pandemic, when schools shut down and mainstream schools began experimenting with online classes, flipped classrooms and blended learning models, the children we were working with, seemed to have lost access to their entire support system. So we created a platform called Tactopus Connect to do just that, connect everyone on a platform, online. This not only connects families with children with special needs to their educators, therapists and specialists who are affected by the lockdown and distancing but also those families in



remote locations with geographic limitations to have access to the best in the field.

Helpful policies to improve adoption of product

In India, products for PwDs attract a goods and services tax (GST) of 5 per cent, making those a bit more affordable and increasing the adoption rate. Similarly, CSR is mandated at 2 per cent from large organisations, and that helps fund products and devices for under-resourced schools and communities.

Supply chain & distribution of AT products & services in India

Both are difficult, to say the least. Especially, when working with CwDs, the market is vastly distributed and stigma-ridden. This makes it not just hard, but also expensive to reach everyone who needs our products and services.

Special financial support for PwDs or start-ups working for PwDs

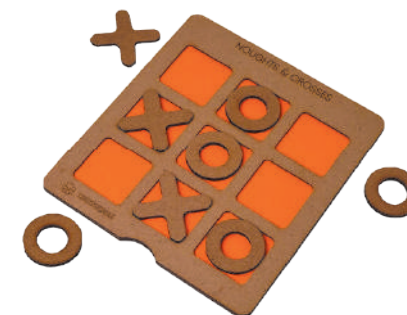
There are a few incubators and grants specifically for assistive technologies. It would be great if like product GST, even service GST could be reduced or waived off for AT companies.

Benefits

Our larger impact goal is inclusion. Hence, while all our products and services are designed for the needs of CwDs, they have universal appeal. Over the past year, we have created more than 12 products that are available with interactive audio in five different languages, and these are being used by over 1,000 children. Starting June 2020, we have hosted over 500 online classes to take learning directly to homes, and aim to create an impact on over a lakh children in the next five years.

Whether addresses a void

It's a little bit of both. There are products and services for children at large and then for those with disabilities. The only difference between us and



AWARDS

Winner at ElevateCall2,
organised by K-Tech
and STARTUP Karnataka
in March 2020

One of the winners
of NCPEDP-Mphasis
Universal Design
Awards 2020

them is that they are far and few, inaccessible, too expensive, or do not have a range for the end user to choose from. Our sole focus is to give them as much choice, personalisation and convenience as possible.

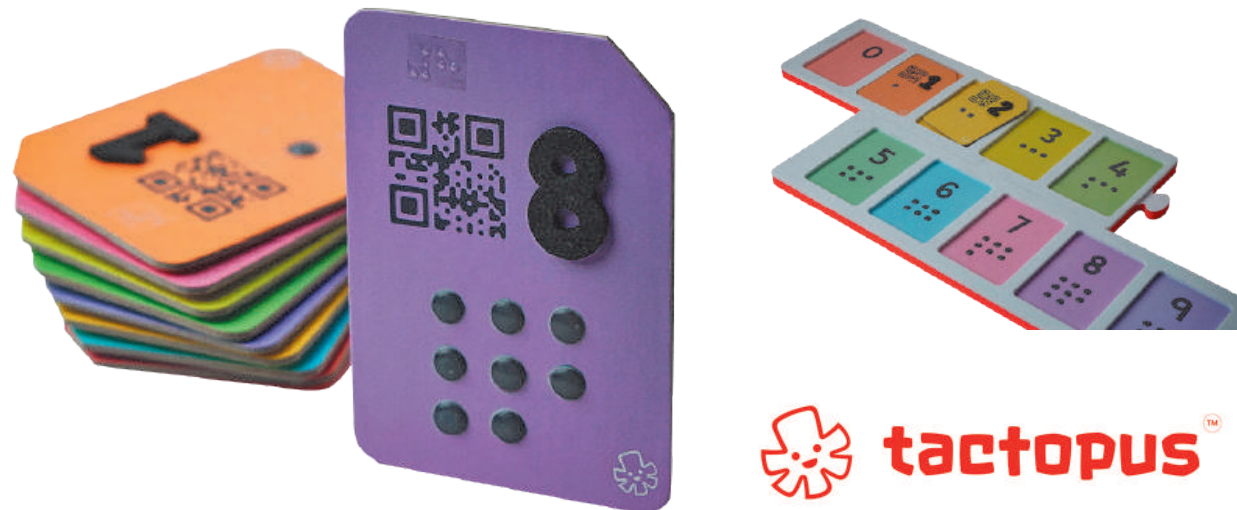
Hindrances & tech challenges

The only issue is that with increased demand, our technology will have to scale. Many things we do manually today will have to be automated to streamline processes and the backend. We have to also continuously upgrade available features and services.

Sustainability, cost-effectiveness, competition

We earn through sale of products and associated services. Our customers are parents of children with special needs (CWSN), special educators and resource centres, and we cater to a global audience.

A typical product is priced between ₹600-₹2,000. For every product type, we hit breakeven on selling about 2,000 units. Similarly, each Tactopus Connect session is priced between ₹650-₹800. Hence, with a reasonable scale, these verticals of the company



will become self-sustaining. Moreover, we intend to add multiple services and digital products, which will allow us to stay cutting edge and relevant, and provide additional revenue streams.

In the specific domain of accessible learning material and products for such children, the existing competition is in the form of NGOs that operate regionally. Rather than see them as competition, we partner with them to reach their existing beneficiaries and convert them to customers using CSR funds, as done with the likes of Samarathanam, Bangalore.

Another kind of competition is the refreshable tablet being developed by several organisations, but these

are extremely expensive and only provide a low-fidelity tactile experience. For mainstream audiences, products created by Osmo and Play Shifu come close to what we are working on but rarely cater to the needs of accessibility.

BIRAC support

BIRAC's Social Alpha AT Quest grant of ₹10 lakhs helped us discount our products and services for CwDs in utmost need but with financial barriers. It is also great and adds credibility to what we do when affiliated with BIRAC.

Market reach

We have created more than 12 products, available with interactive audio in five different vernacular languages, used by over 1,000 children. Beginning June 2020, we have hosted over 500 online classes to take learning directly to homes, and aim to impact over a lakh children in the next five years.

Market penetration strategy

The product is already in the market and established, ready for scale.

Reaching the masses is our key focus to scale. Increased demand would allow us to create an impact on ground and increase scale, making it possible for us to lower production and service costs and become sustainable as a business. We are doing this by increasing digital impact, social media presence, engaging deeper with the community, and spreading the word via influencers and distributors.

With increased demand, our technology will have to scale. We will also continuously upgrade available features and services. We keep an active eye on tech performance and are constantly developing to improve our offerings.

Strategy to approach target market

With products, we reached children through B2B methods of working with their schools and resources centres. It helped us reach and impact more children than would be possible with B2C.

With services, our current process involves using digital marketing to reach parents directly. We use a symptomatic approach to garner attention. The long term strategy is to partner with paediatricians, clinicians, schools who would use our screener to identify kids with additional needs and recommend our services. ■



XL Cinema: Movie-Watching Enhanced for Visually Impaired



Dipti Prasad
Co-founder,
Brajma Intelligent Systems Pvt. Ltd.,
Gurgaon

Company

XL Cinema, a mobile app for the visually impaired, was developed by Brajma Intelligent Systems Pvt. Ltd., co-founded by Dipti Prasad, who studied business at the Manipal Academy of Higher Education and earlier worked with HSBC Dubai. Her founding partner was Kunaal Prasad, an electronics and instrumentation engineer from the Dubai campus of Birla Institute of Technological Sciences Pilani, who specialised in intelligent transportation system and laser-based sensors from Massachusetts Institute of Technology, Boston. Dipti, who looks after business development and expansion, came up with the idea of the app, while Kunaal, who leads the tech team, took up the technical challenge of development.

Product

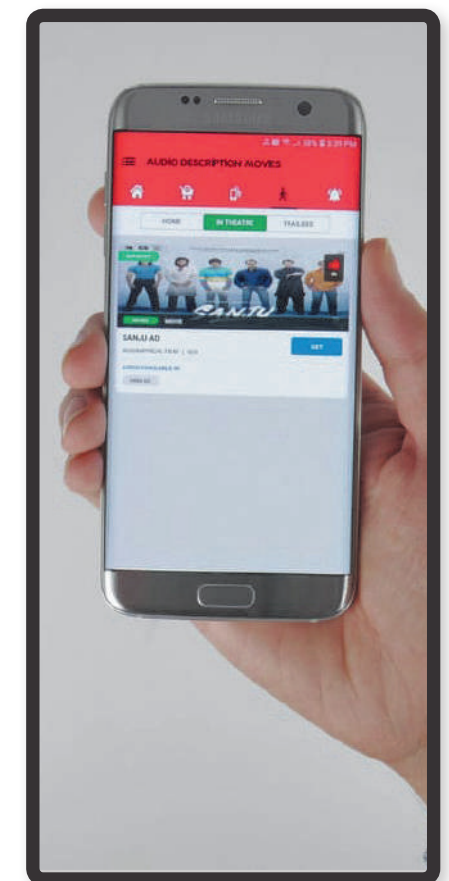
XL Cinema mobile app -an audio content delivery platform-- enables a

visually impaired person to listen to audio description of a movie's content privately, using his smartphone synchronised to the video playing in a theatre or at home. It also enables the user to listen to alternate audio track of a movie in the language of choice privately using headphones connected to the smartphone.

The application synchronises audio description (AD) track or alternate audio track with the help of listening to ambient audio in theatre or at home within a few seconds. The application recognises the ambient audio, and if the requested movie is playing in audible range, then it synchronises the additional AD track in case of visually impaired people. After synchronization, the visually impaired person has to plug in the headphone and listen to the AD track of the movie in sync with the content playing.

This application replaces assistive listening devices (ALDs) and makes every smartphone loaded with it capable of performing like an ALD. It also offers video call help to visually impaired communities. We connect visually impaired people with volunteers and authorised company representatives for assistance through a real-time live video call in language of their preference. We also connect them to volunteers who want to take a step ahead and help them by reading or educating them about non-accessible content like posters, images, text books and diagrams.

No hardware is required in the universal design. A patent has been filed for synchronisation technology and playing. Letting the production houses reach a new market segment is our USP.



Our experience of the Middle East made us realise the need for such a product in breaking language barrier for Arabs watching foreign language movies and later when we understood this problem deeply then we found out that this is not a local rather global problem.

Accessibility barrier

Before our solution, the problem was addressed by providing AD track in a CD or carrying out exclusive shows for the visually impaired. But its reach was quite low. Globally, ALDs have been used in theatre for delivery of AD track to the visually impaired privately. It is expensive and non-scalable.

AWARDS

Nipman Microsoft Equal Opportunity Award 2018

Awarded at the 10th National Centre for Promotion of Employment for Disabled People (NCPEDP)-Mphasis Universal Design Awards

Language barrier

This is currently addressed by providing dubbed tracks and the dubbed movies are played in a few shows to address users of vernacular languages. But this doesn't address the problem of boundary condition, which is huge in terms of number and does not even address occupancy

optimisation. This only partially addresses the problem with several limitations and constraints.

Hindrance

The only hindrance experienced by us was the mindset of production houses and studios as they barely give importance to inclusivity and

accessibility. But funding and support, in general, are major stumbling blocks that still stop a promising new technology in India from reaching users. We have adapted to the pandemic-induced restrictions, and will soon launch a library of AD movies for home viewers with support from Social Alpha.

Sustainability & cost-effectiveness

XL Cinema app is free. We are not aware of any rival AD products in India. The problem of day-to-day support to the visually impaired is currently being addressed by a Denmark-based app called BeMyEyes, but it has attracted relatively lesser number of volunteers in Indic languages. It works for video call assistance.

BIRAC support

A Social Alpha-BIRAC grant of ₹30 lakhs has helped us offer discounts to production houses, sponsor movie shows for under-privileged visually impaired persons, hire manpower to create audio description tracks and new developments.

Market reach

We address multiple markets and have a user base that is having scarcity of products to meet its demands. The user base in the visually impaired community is not addressed and less exposed, and their number is huge.

For XL Movies, an alternate language feature we released directly with the 2018 Telugu language movie *Naa Peru Surya, Naa Illu India* without a pilot, we had close to 10,000 downloads in the first two days of the launch. For AD movies, the pilot was carried with PVR cinema and NGO Saksham. More than 250 visually impaired persons were in the theatre for the show of the movie *Sanju*. The results were amazing and they were exceptionally satisfied and that could be seen from the Playstore reviews. We even signed up with PVR for the promotion and our product was co-branded. On an average, we received 5,000 views per the audio-described movie in the theatre and separate numbers for home viewing. We have done nine titles in audio description so far.

I have found my way to barriers to market access through NGOs, blind schools, radio channels and social media channels. I have personally interacted with them to explain not only about our product but also the story of XL Cinema. ■

Affordable Tactile Graphics for Visually Impaired



Prof. PV Madhusudhan Rao
Raised Lines Foundation
Head, Department of Design, IIT-Delhi

Foundation

To overcome the unavailability of accessible educational materials, especially diagrams, for visually impaired students, we established a Centre of Excellence in Tactile Graphics in 2015 at IIT-Delhi's AssisTech, an inter-disciplinary group of faculty, research staff and students engaged in using modern technology for finding affordable solutions for the visually impaired. The centre was sponsored by the Ministry of Electronics and Information Technology (MeitY).

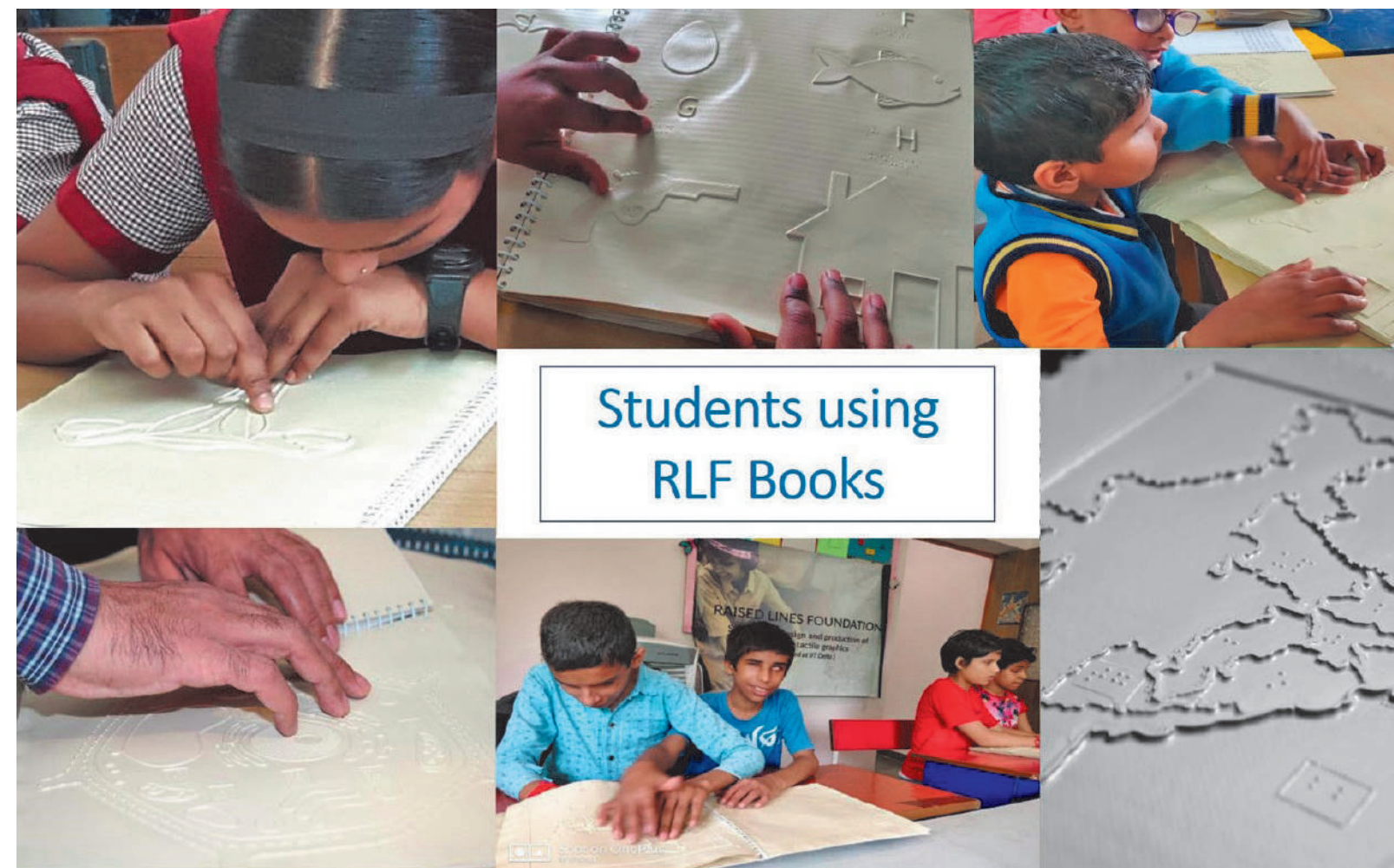
During three years of research, we developed processes for end-to-end design and production of affordable

tactile diagrams. We worked closely with the National Centre for Educational Research and Training (NCERT) and other organisations to validate the usage and efficacy of these tactile diagrams.

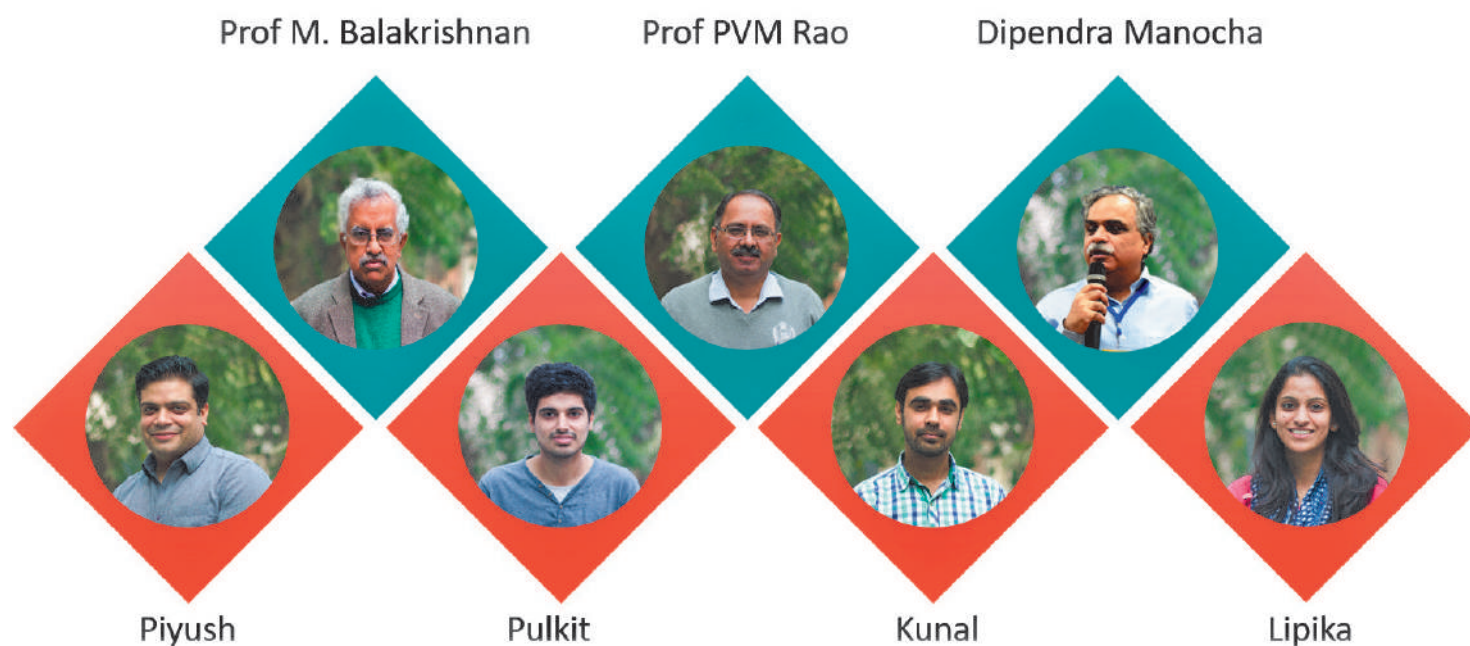
To further scale up the work and expand our capabilities to cater to this immense unmet need, we incubated a non-profit company, Raised Lines Foundation (RLF), in March 2018. We have a team of 12. Apart from me, its board members are Prof. M Balakrishnan from the department of computer science and engineering and Dipendra Manocha, a visual impairment and assistive technology expert.



Dipti & Kunaal Prasad



Students using RLF Books



Product

Tactile graphics are images that consist of raised lines and textures that the visually impaired can use to understand some graphical information using their sense of touch. These are produced using embossing or other technologies on physical medium like swell paper or PVC sheets. The technology is instrumental in education for the visually impaired, where textual content in Braille can be made more comprehensible using tactile diagrams.

In India, many primitive methods of making tactile diagrams have existed for more than a decade. Teachers and special educators have been using household items to produce customised tactile diagrams for students. Also, a few organisations are involved in creating tactile diagrams, and they are either using hand-made diagrams or expensive techniques, which is neither scalable nor affordable to meet the enormous demand for tactile books.

In contrast to the Indian situation, tactile graphics production globally is a well-integrated activity in the education process of the visually impaired. Almost every developed country has an organisation focused on catering to the needs of its students. American Printing House (APH) in the United States and the Royal National Institute for the Blind (RNIB) in the United Kingdom are amongst a few such organisations known for producing tactile diagrams. However, most of these organisations rely on swell paper,

which costs ₹80 per sheet—completely unaffordable in developing countries.

RLF has a team of expert designers and employs the industrial thermoforming process suitable for low-cost and large production, which makes our solution affordable and scalable. We are the only large-scale producer of tactile books in India now to bring this transformational change.

We are using existing processes and manufacturing techniques to create these tactile books. A separate patent has not been filed for this.

Benefits

Most visually impaired students in India at present study without any access to books with diagrams. Students cannot pursue subjects in science, technology and engineering in future, which limits their career opportunities. The overall impact is dependence, low self-esteem and exclusion.

We enable access to affordable books with tactile diagrams and other learning resources. We have in-house competency to convert, design and produce high-quality tactile graphics that a visually impaired student can comprehend via touch.

Focus areas

1. Develop and produce affordable, simplified, perceivable tactile version of visual diagrams from textbooks for all age groups in all Indian languages.

2. Special focus on making science and mathematics diagrams accessible: Already created a tactile version of NCERT textbooks for these subjects.
3. Develop teaching-learning and aid material
 - a. Enable students to create diagrams on their own
 - b. Empower teachers and parents with appropriate material and aid so that they can teach efficiently and effectively
4. Affordable and efficient service for conversion of any material in accessible format in the language of their preference
 - a. Building layouts, greeting cards, official documents, Braille labels, etc.
 - b. Enable access to materials for visually impaired persons irrespective of age, profession and type of document

Hindrances and tech challenges

A tactile diagram is not a direct conversion of a visual image to the raised representation since information gathered by touch is sequential and limited to perception. This poses a major challenge while designing such a diagram. Further, production methodology should be adaptable to the demand of the diagram to make it cost-effective. To overcome these challenges, multiple iterations were done to standardising the design and production of tactile diagrams.

1. **Design:** Design involves the conversion of 2D scanned images to

tactile graphics. Initially, designing was limited to manually recreating the diagrams, but now professional graphic design software like CorelDraw and Photoshop are used for tracing and editing the diagrams. Further, to reduce the complexity of the image and make those easy to comprehend, international guidelines have been adopted and rules created based on user feedback.

2. **Production:** The production methodology should be based on the demand of the diagram and its complexity to minimise the production cost per diagram. Therefore, a variety of techniques are used. For small quantities, embossing is used for simple diagrams, and swell touch paper is used for complex diagrams with lots of features.

For large-scale production, instead of embossing or swell touch paper, we employ the thermoforming process, which requires a master mould that was made manually earlier but is prepared now using 3D-printers. This reduced mould-making time and increased accuracy and repeatability.

Sustainability, cost-effectiveness & competition

The innovation is sustainable and unique in multiple ways:

- **Affordability with high quality:** These books are available at a fifth of the cost of similar products available abroad with the same quality standards.
- **Huge demand:** These books are required at every phase of education, from early childhood (story books) to higher education.
- **Adaptable:** Books can be made easily in any language with minimum effort. Only the Braille content in the text has to be changed through translation.
- **User-centric development:** The content is developed in consultation with special educators, subject experts and end-users.
- **Scalable production process:** We have a standardised production process that can be replicated easily to meet large-scale demands.
- **Holistic approach:** Go the extra mile to ensure the adoption of solutions through training and support services.

In India, Tactile India and Ael Data use expensive swell-based techniques to create tactile diagrams and

cater mostly to international markets. Include, Tactopus and Touchvision use the deposition to produce tactile diagrams, which is again expensive and not suitable for large-volume production.

BIRAC support

We were incubated under Social Alpha in 2019 and a recipient of BIRAC-Social Alpha Quest for Assistive Technologies, supported by an Mphasis grant. We were amongst 14 winning start-ups chosen from over 100 applicants based on their business model, technological innovation, product-market fit, focus on affordability and accessibility and socio-economic impact.

The support received through this award helped a lot in two major aspects:

1. **Access:** We created new content in multiple languages. We launched more than 15 titles last year and subsidised the cost for the end users. A discount of 25-50 per cent helped in reaching a larger audience across India.
2. **Awareness:** We ran a country-wide outreach campaign to make students, teachers, schools and organisations aware of such resources and how they can be utilised effectively. We reached out to 140 schools and organisations and sent samples to 84.

Commercialisation stage, market penetration

The tactile books are available in the market. RLF has designed more than 30 titles comprising more than 2,000 diagrams. We have produced over 6,500 tactile books with two lakh tactile diagrams in the last two years and disseminated them to over 50 schools and institutions. Our books are being used in more than 30 cities.

Our direct beneficiaries are students with blindness and low-vision, parents of these students, special educators and teachers. But only a small fraction of our beneficiaries can be reached directly; and therefore, we need to connect further through special schools and organisation for the visually impaired and inclusive schools that have such students.

However, due to limited financial resources, schools and organisations are unable to provide these resources to every student. Thus,

AWARD

One of the winners of 'Innovate for an Accessible India' (IAI), a NASSCOM Foundation and Microsoft India initiative in partnership with DST and MSJE

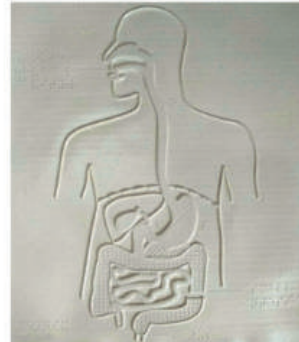
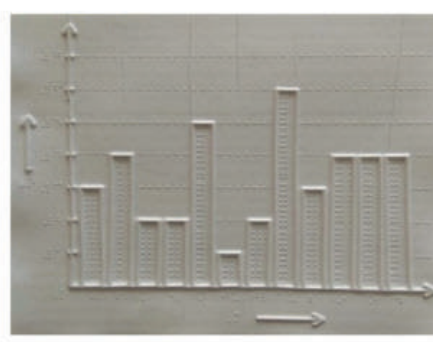
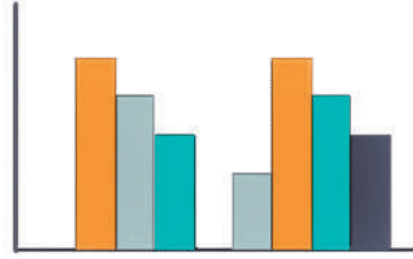
we pursue fund-raising channels to make educational material available for all. We seek support from the Samagra Shiksha Abhiyaan (SSA), NCERT and state boards, CSR units and individual donors. Further, we explore provisions to get these resources listed under government schemes for providing assistive technologies.

For direct sales, we have collaborated with AT-enabling organisations like Saktek, the Xavier's Resource Centre for the Visually Challenged, Mitra Jyoti and Enable India. We are also connected with Saksham, Daisy Forum of India, and Eyeway to create awareness about these solutions and information dissemination.

Addressing disconnect between innovation centres, end user

Inclusive education is necessary to provide an equal learning opportunity to all students irrespective of their abilities and promote mainstream integration of students with special needs. The availability of technology and accessible learning resources plays a vital role in that. Globally, creating such resources is a well-integrated activity, but in India, the access is reasonably limited. We envision to overcome this gap and ensure that visually impaired students have the same opportunities as their sighted peers.

Conversion of Visual Image to Tactile Diagram

**Stumbling blocks to reaching users**

1. Despite making tactile diagrams available at such a reduced cost, a large percentage of visually impaired school students still cannot afford to buy these on their own. Therefore, we depend on financial support mechanisms.
2. Just providing these books to students does not lead to the adoption of these books in a classroom curriculum; training is a must. RLF team works at the grassroots level with organisations and schools. We This requires a lot of time, effort and resources, limiting us in scaling at a higher pace.
3. Till date, the maximum reach of any assistive technology has been through government

distribution channels, where end users receive the technology for free. There are two such schemes: Assistance to Disabled Persons for Purchasing /fitting of aids/appliances (ADIP) and Inclusive Education for Disabled at Secondary Stage (IEDSS). Funds are available under both. But getting enrolled in these schemes requires a lot of advocacy, and that further limits us in reaching maximum users.

Other assistive tech being developed

We work closely with IIT-Delhi and the Saksham Trust, where IIT helps us in development from research aspects, and Saksham helps us in user engagement and dissemination or such aids. Some of the other

developments going on at our foundation are:

1. **Braille factor blocks:** A game for visually impaired kids to learn numeracy concepts. The collaborator is Microsoft.
2. **Geomkit:** A geometry kit so that students can recreate geometry concepts on their own. The collaborators are Vistrit Gyaan and the Saksham Trust.
3. **Cane repair kit:** A very low-cost solution that the user can use to independently repair a white cane.

We are also working on process automation so that other organisations can utilise tactile production technology to meet their demands. ■

**Pulkit Aggarwal**

Investment Director-Assistive Technologies, Social Alpha

An alumnus of Delhi Technological University with an engineering degree in polymer science and chemical technology, Pulkit Aggarwal is responsible for leading investment across the AT sector, for building the incubation support system, and for supporting and monitoring incubated start-ups by testing new ideas and creating innovative go-to-market (GTM) models. Social Alpha has incubated and funded 16 AT start-ups.

Perspective on Indian AT landscape; sector's evolution, potential

The World Health Organisation estimates that over a billion people live with disability across the globe. With a global ageing population and rise in non-communicable diseases, it has been estimated that more than 2 billion people will need at least one assistive product by 2030, with many older people needing two or more devices.

A few incubators over the last few years have taken the lead in supporting the AT market. Moreover, the government is also coming forward in providing support to this ecosystem. One such support was the public-private partnerships called 'BIRAC-Social Alpha Quest for Assistive Technologies supported by Mphasis'. The government has also started putting great emphasis on inclusive infrastructure and design using AT to promote inclusive education and employment.

Though the need for assistive technologies is well established, India lacks a vibrant market of disruptive AT solutions that can uplift people with disabilities. This is because the AT industry's value chain is broken; and distribution, sales and service mechanisms are poorly established, and, in many cases, non-existent. We have a long way to go in terms of creating a sustainable AT market and promoting innovation and entrepreneurship in this sector.

Suggestions for early-stage tech start-ups developing solutions for PwDs

Affordability and user experience are the key to large scale adoption of any AT. Start-ups should focus on validating the product-market fit and generating objective clinical evidence.

Instead of reinventing the whole supply chain, start-ups should focus on bridging gaps that exist in the distribution and service channels. They should identify the key stakeholders in this market like schools, rehabilitation centres, NGOs and clinics, and collaborate with them to deliver their technologies to consumers.

Moreover, start-ups should also recognise market beyond Indian boundaries early on, and aim for country-specific certification and clinical evidence so that they become global players.

There also needs to be a larger focus on the importance of **universal design**, for better adoption of technologies across all sections of society, such as geriatrics, the sport industry, and rehabilitation market.

Policies or support system available for start-ups working for PwDs

An immediate solution is to develop a financial instrument that makes existing high-quality technologies and solutions more affordable and accessible for the end user. Further,

allowing easier market entry for technologies. This will allow:

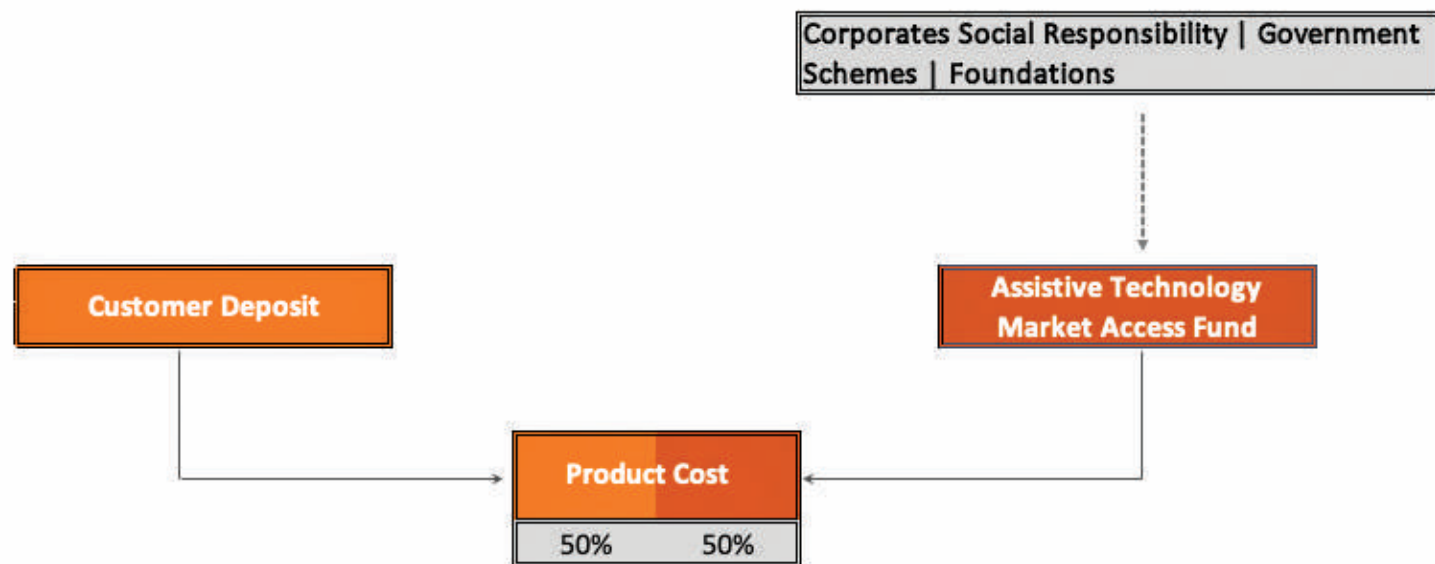
- Development of sustainable financing models to reduce out-of-pocket expenditure for PwDs.
- Economies of scale by improving the initial market demand.
- This demand creation can in turn increase the risk capital inflow in the AT space.

On a larger scale, stakeholders can come together to create a database about the availability of appropriate assistive devices and technologies. Social Alpha is working towards the goal through its AT open innovation platform for providing easy access to new innovation.

Reason behind relatively limited number of AT innovators

Seeing the success of support infrastructure created by BIRAC for healthcare ecosystem, one immediate way to promote innovation in this space is to create similar specialised assistive technology fund that can be accessed by all incubators that wish to provide a dedicated support for following:

- 1) Developing thesis and know-hows of the AT sector
- 2) Specialised R&D infrastructure for AT and access to users for rapid prototyping and feedback



- 3) Creating a network of experts who are working across different disabilities and bring together the community on a single platform
- 4) Prototyping grant for AT start-ups

Bottlenecks to creating sustainable demand & market access

Some of the major bottlenecks in the AT market are:

1. **Lack of product development and research infrastructure:** This has resulted in extremely limited number of innovations that we see in the market as compared to other sectors.
2. **Affordability and sustainability:** A large number of children with disabilities stay out of school and an exorbitantly large number of PwDs remain unemployed as the society does not have an inclusive environment to accommodate PwDs. Moreover, to lead a sustainable lifestyle, the expenditure of the family grows exponentially high. Hence customers are unable to afford the very technologies that can provide assistance for independent living. This makes it extremely hard for AT start-ups to create a sustainable demand.
3. **Poor market access and poor infrastructure distribution:** The market is fragmented, with poor user data. This results in inefficient sales and

distribution channels and leads to solutions being concentrated in urban hubs.

4. **Investments:** Market-driven solutions backed by venture capital and debt financing are extremely limited.
5. **Manufacturing:** Limited manufacturing partners in value chain.

Ways to promote domestic & international risk capital for AT sector

The need for assistive technologies is well established; however, an immediate problem is to create a sustainable demand in the market by reducing the expenditure for PwDs in procuring these solutions, rendering affordability as the key focus area of the sector.

Social Alpha is introducing, a blended financing model, called the Assistive Technology Market Access (ATMA) Fund. The fund will finance up to 50 per cent of selling price for the initial users, improving access and reducing the expenditure for procuring new products. This will lead to improved affordability and access of assistive technologies to the unserved and the under-served population.

The fund will ease the entry of AT solutions into the market, reduce the expenditure for end users, and eventually help the start-up scale its product in the market. This, in turn,

will allow for economies of scale by improving the initial market demand.

This demand creation can then increase the risk capital inflow in the AT space.

How can start-ups collaborate with NGOs?

Across disabilities, a large number of NGOs are providing the required interventions, solutions and advocacy support to this sector. A large number of PwDs today are able to not only live independently, but also access education and employment opportunities through their efforts.

NGOs in this sector are the biggest stakeholders without whom start-ups won't be able to deliver solutions. There are a few aspects that start-ups should look forward to in terms of collaboration with these stakeholders:

- A. NGOs as knowledge partners could help identify and refine start-ups' problem statement and solutions.
- B. NGOs as prototyping partners offer access to users, clinicians, therapists and experts who could help in rapid product testing and prototyping.
- C. As access partners, NGOs can act not only as a resource centre to host new technologies, but also as a distribution partner and post-sales service partner. ■

Kibo: Enhanced Learning for Visually Impaired



Akshita Sachdeva
Co-founder, Trestle Labs Pvt. Ltd.,
Bengaluru

Company

During the third year of my Bachelors course from Manav Rachna College of Engineering, Faridabad, I worked on a project that could help blind

and visually-impaired people navigate unknown environments using obstacle detection and listen to printed text by just pointing at it. When we approached the National Association for the Blind, Delhi, to test our device, a little kid's positive response to our device was a pivotal moment.

Trestle Labs was founded in November 2017 along with Bonny Dave, a mechanical engineering graduate from the Nirma University, and Abhishek Baghel, an instrumentation and control systems engineering graduate from Bharati Vidyapeeth's College of Engineering, Delhi. Its aim is to empower the blind and visually impaired towards inclusive education and employment by revolutionising the way they read, learn and access multilingual content through audio in real time.

Problem statement

Around 253 million people worldwide and 57 million in India are visually impaired. The Indian number includes 12 million blind. They don't have equal education and employment

opportunities as they cannot access printed, handwritten and digital content on their own. Only 29.16 per cent are part of the education system and 6.86 per cent schools have Braille and audio-content, according to a survey by NCERT.

They are heavily reliant on Braille and audio books. While less than 1 per cent content is available in Braille, it takes four to six weeks to record a 300-page book. Late blind individuals often don't learn Braille. Regional language content is also inaccessible as there are no tools to cater to Indian languages.

Products

Our innovation Kibo enables one-stop access to any printed, handwritten and digital content through audio in real time, empowering persons with blindness and vision impairment to listen, translate and digitise any content across 12 Indian and multiple overseas languages. The Indian languages are English, Hindi, Sanskrit, Bengali, Punjabi, Gujarati, Marathi, Tamil, Telugu, Malayalam, Kannada and Urdu. A patent is pending for our innovation.





Kibo comprises three products:

- **Kibo XS device:** India's first multilingual scanning and reading device that seamlessly connects to any computer, laptop or Android phone, and helps access printed and handwritten documents through audio. It can translate text in more than 100 languages and digitise documents in editable unicode formats. i.e, doc, docx and txt.
- **Kibo mobile app:** A solution to listen to multilingual digital documents across nine file format—docx, txt, PDF, epub, daisy, mp3, opus, jpg, png, it makes audio and text notes accessible. One can search and download books from a repository of a million books in collaboration with digital libraries.
- **Kibo Desk SaaS:** A web application to make images and scanned image-based PDFs accessible through audio, translate text across 100+ languages and digitize documents in editable unicode formats - .doc, .docx and .txt

Benefits

Apart from promoting inclusion in society, our products and services assist the visually impaired in primary and higher education, informed decision making, preparing for competitive examinations, get employed and achieve socio-economic independence.

Whether addresses a void

While imported scanning and reading solutions for the blind, such as SARA-CE, ORCAM Reader, Lex Air and Eye-Pal Reader, have existed for a long time, they only offer support for English and other Latin-based languages. These are expensive as well. Our innovation focusses on Indian languages, which was a big void earlier.

Hindrances & tech challenges

The barriers were more around the right application of technology as our

tech stack includes AI/ML, cloud computing, web and mobile platforms. We also had a tough time initially finding the right ecosystem partners, NGOs, distribution partners, customers who could provide us with the right validation and provide us with market access.

Cost-effectiveness

To ensure adoption and affordability, we offer all this with ten times more features at a sixth of the price of global competitors.

BIRAC support

While our Kibo XS device is priced at ₹26,999 (plus 5 per cent GST), we are able to offer financial support to the visually impaired, NGOs and donors who can buy the device at a subsidised price of ₹18,999 (plus GST) because of the generous subsidy support by BIRAC, Social Alpha and Mphasis. Through subsidy, we could reach additional 200 beneficiaries.

Market reach & penetration

More than 160 Kibo XS devices are deployed across 20 states and exports have started to Kenya, Ghana, Tanzania and Singapore. Over 33,000 visually impaired individuals have been benefited by the Kibo mobile app across 15 countries, with more than 5,000 daily active users.

More than 11 million PDF pages have been processed and made accessible with Kibo and around 3.5 million documents have been made accessible.

We have Amazon, Saktek, LetsEndorse and CSRBox as our e-commerce partners for India now. As part of scaling up, we will register with the Government e-Marketplace (GeM) portal and partner with e-commerce platforms like Amazon Global Marketplaces and Flipkart.

We plan to partner with more AT distributors across the globe to increase our geographical presence. We also want partnerships with states and the central government to institutionalise Kibo XS deployment across schools, colleges and universities. Plans are also there to collaborate with the government's assistive aid distribution initiatives to distribute Kibo XS devices and pre-install Kibo app on smartphones distributed to the visually impaired under government schemes.

We are keen to launch online campaigns and join hands with NGOs to train visually impaired students and conducting workshops and training

AWARDS

Winner on the pitch day under the Leaders in Innovation Fellowship (LIF) programme by UK's Royal Academy of Engineering

Winner of Tata Social Enterprise Challenge, 2020

sessions—online as well as offline—to raise the visibility and reach of Kibo products.

Supply chain & distribution of AT products & services in India

We have specific manufacturing, logistics, distribution and delivery partners, who help us streamline the supply chain and distribution of our products, both in India and overseas. The factors that play a key role in streamlining supply chain are geographical replicability and scalability of products to suit the needs and demands of the linguistically diverse population in India.

Specific financial support for PwDs or start-ups working for PwDs

While there is a dedicated annual financial support offered to PwDs in other countries to purchase AT products, there is no such allowance in India. However, under the ADIP scheme, assistance is provided to disabled persons in obtaining standard aid and appliances, but the aid are selected by the agencies involved in distribution.

While there is no dedicated financial support for start-ups working for PwDs, organisations like DBT BIRAC, Social Alpha, Mphasis and Prosus have come forward to support AT start-ups by organising start-up competitions, grant funding and awards to boost the growth of AT ventures. ■

ArmAble: Arm Rehabilitation Device Gamified



Habib Ali
Founder-CEO,
BeAble Health Pvt. Ltd., Hyderabad



Sreehari KG
CMO

Company

BeAble Health started in 2017 at IIT-Hyderabad's Centre for Healthcare Entrepreneurship (CfHE). We are committed to improve health and lives through design and technology. I am a biomedical engineer and co-founder and chief marketing officer Sreehari KG is a design & communication professional. We are together solving the need for intensive, engaging and regular rehabilitation for patients and equip doctors and physiotherapists with affordable, game-based, data-driven devices for better therapy efficiency and outcome.

Product

Our product ArmAble solves a pressing need for intensive, engaging and regular rehabilitation therapy for





AWARD

Start-up of the Year in the rehabilitation technology category at the Business Mint 5th Edition NationWide Awards, 2020



patients with upper motor deficit due to conditions like stroke, cerebral palsy, multiple sclerosis, traumatic brain injury, fracture, frozen shoulder. The tool is a game-based rehabilitation device. The games fit into Indian cultural milieu and suit various age groups. These increase the adherence of patient towards therapy. The app connects doctors and therapists to patients by remotely connecting through a cloud platform. The therapist can monitor and analyse the progress of the patient's recovery by looking at movement data like patterns, speed, accuracy etc. The app connects products, patients, games, data and payment into a single platform. The innovation was granted a patent in 2019.

India has more than 18 lakh strokes every year. More than 12 lakh of these suffer from upper limb disability. Due to financial burden and high recovery time, patients drop out, leaving many with a disability. Despite high efforts put in by therapists, the outcomes are low.

Advantages

- ArmAble augments improved therapy efficiency.
- Promotes all kinds of upper limb motion.
- Increases the number of repetitions in the patient, leading to neuroplasticity—the ability of the nervous system to change its activity in response to intrinsic or extrinsic stimuli by reorganising its structure, functions or connections.
- Patients can themselves use the device that increases adherence to therapy.
- Doctors, physiotherapists, neurologists can visualise the recovery and therapy progress.

- Helps in bio-feedback and movement retraining; require less manpower.
- Is ready for tele-rehabilitation through BeOne software platform.
- Makes physiotherapy affordable and accessible while reducing the burden on therapists.

Sustainability & cost-effectiveness

Our innovation is an 'Atma Nirbhar' product. It is substantially cost-effective compared to imported products available in the country. Most of the raw materials used are either manufactured or sourced from within India.

BIRAC support

BIRAC supported us through grants like Biotechnology Ignition Grant (BIG) and Small Business Innovation Research Initiative (SBIRI). We also received its support when it showcased our products through exhibitions, conferences, videoconferences, etc.

Strategy of commercialisation, market reach & penetration strategy

Our initial pilot studies have shown significant improvements in patients using our device. A more detailed study is under way. The product is now ready for deployment. We intend to penetrate the market in a phased manner—four phases, with each covering five states. We will target 300 customers in each state.

The strategy involves reduced pricing, i.e. it will be made available at a fourth of the cost of similar products sold by competitors. In phase IV market expansion, we are looking forward to exporting our product and spinoffs in the United States, the United Kingdom and Europe.

To capture the market, we will provide incentives for doctors and physiotherapists.

Stumbling blocks to a promising new technology reaching users

The lack of a set of people with the right, common mindset and financial backing to build, test and bring a new technology to market is a big hindrance.

Plans for other assistive tech products

ArmAble is our first product aimed only for upper limb. We do have plans to manufacture other game-based rehabilitation tools to cater to demand.

Barriers to market access for assistive tech products

The key barrier to market access is the willingness and mindset to spend in this segment. The customers in B2B and B2C segments both have a hesitation to spend. The society considers spending on assistive technology as something that does not offer much return on investment, and thus hesitates spending in this area. ■



Soikat Ghosh Moulic

Clinical prosthetist & orthoptist
Associate professor & associate director-technical & quality systems
(rehabilitation services & product development), Mobility India

Soikat Ghosh Moulic has over 23 years of experience in technology transfer and setting up assistive device centres in India and other developing countries. He is a member of the sectional committee under the Bureau of Indian Standards working towards standardisation of assistive devices and is a member of the advisory board of the Society for Biomedical Technology (SBMT) at the Defence Bioengineering and Electromedical Laboratory (DEBEL), Bengaluru. He is also on the advisory committee of Grasp Bionics, a start-up incubated in the Indian Institute of Science, Bengaluru, which is working on myomechanical prosthetic systems.

Perspective on Indian assistive tech landscape; sector's evolution, potential

The AT landscape in India is at a nascent stage, through the need for that is significant in the country with growing incidences of persons with disabling conditions. The challenge that India is going to face in the next decade will be that with the growing number of older people and those with non-communicable diseases. By 2050, India will have the largest number of older people in the world; India now is ranked third with Japan and China leading. The sector is not getting the due importance that it should get. The investment in R&D for the right kind of AT and assistive devices involving the academia, industries and the services sector is not significant.

In the last ten years, some attention has been paid to this sector, mainly from the government, private sectors and NGOs. The AT sector in India could be an industry worth over \$2 billion provided we bring ourselves at par with the developing world. The scope for joint developments in the engineering and allied health sector with focus on AT ecosystem is immense. The involvement of IITs and some engineering institutions in the AT space has highlighted the need for more investment and development in the sector. This trend will need to be supported by the multi-sectoral approach of the state and private stakeholders. India could become a centre of AT development. The

need for AT in India is 'one in seven' now and will become 'one in five' in another two decades.

Suggestions for early-stage tech start-ups developing solutions for PwDs

Most early-stage tech start-ups are evolving with the noble idea of creating something new. However, the need and scopes are not matched to the extent required. The pathway for the development in these start-ups seems to be in a bigger hurry of go-to-market approach, which often does not lead to sustainability.

Every start-up needs to focus on the issues and challenges of the PwDs in relation to the appropriateness, availability, accessibility, applicability and affordability of the solutions (5A of AT). The focus needs to be on the environment, socio-economic and geographical requirements, community status and support systems.

Every start-ups in the AT space needs to have on board like-minded and competent allied health professionals like prosthetists, orthotists, therapists and other domain experts. There has to be assurances of proper quality control, clinical trials and validation of the concepts, users' feedback and iterations, and enough evidences of user perspectives in various communities. More than 75 per cent of PwDs in India are in the rural areas. Every product needs to have the standards developed and registered with the Bureau of India Standards.

Policies or support system available for start-ups working for PwDs

The lives of persons with disabilities are governed by specific policies. However, there are not specific policies for start-ups working for PwDs.

The government need to change its approach towards PwDs from a model of charity to a model of service provision. India needs to develop on priority a robust national assistive technology policy and formulate the National Priority Assistive Devices list, which should include all domains in line with a similar list maintained by the WHO. The government needs to support AT development through ethical pathways with proper governance as a mandatory regulation.

Reason behind relatively limited number of assistive tech innovators

The innovators in the AT sector are limited compared to other sectors as the field is still not a brand. AT sector has not been included as a health issue in India. Products are still items of charity and mostly branded free. The sector also failed to cultivate brand ambassadors unlike other sectors.

As mentioned earlier, the investment on R&D in the AT space has to increase and access to such funding and grants. Investment needs to be made easier to attract. The time taken to approve innovation proposals could be reduced and well regulated. Initiatives for innovation and development from developed

countries could be brought into the domestic space with proper collaboration with academia, industry and the services sector. This could reduce time and effort in reinventing the wheel.

Students of technical institutes, allied health institutes, industries could be properly rewarded for coming out with appropriate AT solution concepts linking with the common challenges of the communities.

Bottlenecks to creating sustainable demand & market access

The major bottleneck is missing out on proper implementation of the 5As of AT development. A common challenge is not having proper market research done across communities to understand the real issues and then working towards solutions.

Creation of sustainable assistive tech business by start-ups

Every start-up will need to have clear understanding of the 5Ps of service provision and develop the innovation linked to policies, personnel, provision, people and performance & promotion.

Start-ups need to have a long-term strategy of sustainability in the space with ample scopes for upgradation and further developments on the first generation of development to the next generation with little effort. Proper branding and promotion is also necessary.

Ways to promote domestic & international risk capital for assistive tech sector

One of the important steps in the innovation of AT is protection of the intellectual property created. A lot of focus will need to be given on the scope for technology transfers to other regions and regulated small- and large-scale pilots in regions that faces similar challenges.

In any sector, the venture capitalists will see the economics and profit sharing. The ideologies of such capital investments in AT sector will need to be looked into in a different perspective. There will have to be lots of hand holdings with the start-ups as most may not have clarity on the capital market and the economics of AT sector at the initial stages.

How can start-ups collaborate with NGOs?

The start-ups will need to scan and identify NGOs that are effectively working in the ecosystem and have credibility. Background details will need to be gathered and confirmed. It is always suggested that domain-specific NGOs with a professional workforce could be identified and proper formalities completed to carry out objectives-based, time-bound collaborations. NGOs having strong roots in the communities in the region with effective problem solving and service provision history ought to be selected. This could enable large-scale access to communities of people and market for AT solutions.

Successful business models/policies/financial support system in mature markets that can be replicated in India

The AT sector will need to be covered under the social security programme in India. The insurance sector will need to cover the service provision of AT like the health sector. This approach is already operational in many developing countries. Including the AT sector in insurance and social security programmes will ensure acceptable quality standards, assured standards of professional service delivery and call for checks and measures.

Suggestions to raise the reach of assistive tech products

The 5As and 5Ps need to be followed in every stage of development of AT products. The concept of AT should be integrated into the curriculum of allied health and technical programmes at the university level.

Mandatory clinical trials and product validation are needed to ensure uniform testing and outcome measures with the end users as the focal point. Networking with various stakeholders across all domains of conditions and communities is also necessary.

Robust last mile connectivity and assured follow ups, repairs and maintenance must be ensured in all zones. Data on the use of AT should be collected using technology and its impact measured. ■

TurnPlus Swivel Seat Mechanism for Cars



Anand Kutre
Founder, True Consultancy, Bengaluru

Company

I am a mechanical engineering graduate from the Gogte Institute of Technology, Belgaum,, passionate about product development. I then worked in Pune for a few years. I shifted to Detroit in 2000, where I worked for Chrysler's jeep and truck division. In 2006, I moved back to India and started Augen Technologies, an engineering services company in Bengaluru, with a friend. I moved on in 2010, and started True Consultancy, a start-up whose core focus was innovation.

The company was not started for the disabled. Instead, our main goal was to create societal impact. During its initial days, True Consultancy worked with Toyota, which wanted to launch in India something similar to its Welcab

project, which is engaged in making cars accessible in Japan. I made a few designs that were patented by Toyota, but those didn't take off. I continued working on the problem, came up with my own and much better design, and applied for a patent. We have more than 100 happy customers who have found TurnPlus useful.

Inspired by people's feedback and encouragement, I decided to create a whole line of AT products from mobility perspective for PwDs.

Product

TurnPlus, launched in 2017, is an easy to install, swivel seat mechanism for cars that provides assistance to the differently-abled and helps create an inclusive ecosystem. It is designed to make car travelling easy for people



with special medical conditions like multiple sclerosis, rheumatoid arthritis, leg amputation, callipers corrections, Parkinson's disease, osteoarthritis, paralysis, and issues with knee and spinal cord. TurnPlus also helps in challenges faced due to old age and pregnancy. We have filed for a patent.

Benefits

Current PwD-centric mobility solutions for vehicles in India are mainly local modifications that are largely dependent on the local garage, where issues related to safety and reliability are not addressed. This makes those non-scalable and inconsistent solutions. It also takes a lot of time to get these solutions installed. There are imported solutions that are expensive and have just a couple of dealers across India. The car has to be delivered to these locations and modifications are made there. This adds to the cost and creates other logistics issues. In case of any problem with the product, service is another concern.

With TurnPlus, the original seat, along with its track and reclining motion, remains intact. The seat is removed, the mechanism is installed, and the seat is put back. There is no modification to the car's structure or core functioning. It is maintenance free as it does not require power or batteries and is manually operated. It can be installed in 90 per cent of Indian car models.

Whether addresses a void

It is filling up the void of not having standardised solutions for accessibility developed in India for Indian car models.

Hindrances & tech challenges

Due to lack of resources, we took a longer time to develop the design, perform various tests as per the Automotive Research Association of India (ARAI) standards and market reach. A major

issue we continue to face is the lack of visibility of such products in India. We want to build awareness about such products.

Sustainability & cost-effectiveness

Our major competition is with imported variants. The cost of our product is less than half of that of the imported variants.

BIRAC support

The BIRAC award definitely was very encouraging. Our confidence and direction of our offerings became clearer. The fund helped us with develop newer products that compliment the existing product, helped us with building awareness to some extent, and scale.

Market penetration strategy

TurnPlus has been in the market from August 2017. Our growth has been very organic. We need to build awareness with marketing and advertising, cultivate a pan-India sales team and a distributor network. We target both B2C and B2B customers.

Stumbling blocks to promising technology reaching users

We are unable to build awareness of our solutions across the country—a major problem we face at present.

Plans for other AT products

We are in the process of developing the advanced versions of our solution. We are developing other complimenting products like car hoists, portable light weight ramps, transfer boards and some other solutions that aid with mobility challenges.

Barriers to market access for assistive tech products

The barriers include lack of proper advertising & marketing, cost disadvantages, problems in distribution and economies of scale, and regulatory ones. ■

AWARDS

Winner of BIRAC-Social Alpha Quest for Assistive Technologies, January 2020

Winner of ElevateCall2, organised by K-Tech and STARTUP Karnataka in March 2020

One of the winners of NCPEDP-Mphasis Universal Design Awards 2020

One of the winners of Starable Startup Competition, November 2020

See Sound Live: Hearing with Eyes



Dr. Shomeshwar Singh
Otolaryngologist
Founder-Director,
4S Medical Research Pvt. Ltd.
New Delhi

Company

4S Medical Research Pvt. Ltd started as the research arm of ENT and cochlear implant surgeon Dr. Shomeshwar Singh. To improve outcomes of cochlear implant surgery (bionic ear surgery for deafness), he conceived the innovative concept—later named See Sound Live—wherein those with impaired hearing can receive feedback of their speech efforts through their eyes, i.e., hearing with eyes. This allows the deaf and dumb, who depend primarily on sign language, to learn to speak like regular people using their heightened visual processing skills. Our company is now fully committed to the development and distribution of this product worldwide.

Product

See Sound Live is the first invention of its type in the world wherein a deaf

person tries to get feedback of his speech efforts by looking at patterns on his smart phone while he attempts to speak. Repeating the same sound creates the same pattern and uttering a different one changes the pattern. In essence, the user gets a feedback of his speech efforts and, therefore, can use this feedback to develop speech.

This is the only application that uses this technology to help the deaf communicate with others using speech in addition to sign language. We have closed the patent application in India and are in the process of filing it in the United States and Europe. This will be completed by April 2021.

Target groups

The product is targeted at children in deaf schools. Currently available in English and Hindi, it can be developed for every language in the world.





Children with impaired hearing can build their speech vocabulary if they use the technology on a smartphone regularly. For deeper penetration, this may need assistance from the central government and corporate social responsibility (CSR) funds.

Whether addressed a void

Current options for deaf children are confined to sign language only. Sign language will continue to remain important for this group. But using See Sound Live, these children can also develop speech, which will allow them to interact better with others who do not understand sign language.

Hindrances & tech challenges

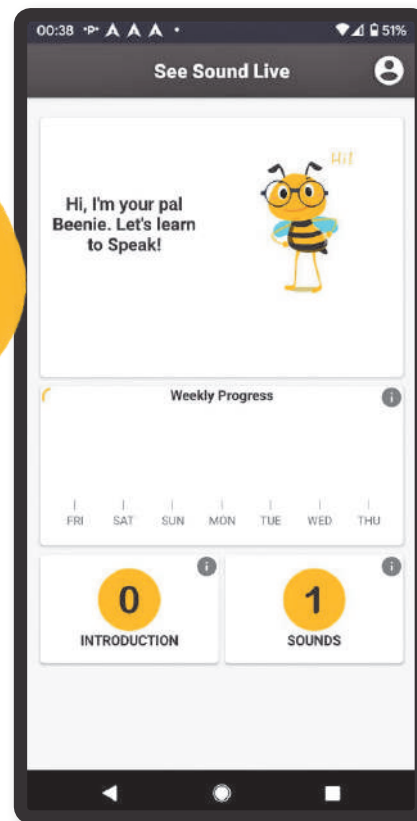
See Sound Live is a novel concept. We needed to develop a very strong bridge in the understanding of this concept between signal processing engineers and medical professionals. Once the concept was well understood by sound engineers, they could develop the algorithm that converts a spoken sound into a visual equivalent. This was then tested for feasibility and reliability for use in children, and ultimately packaged inside a smartphone for easy access.

Sustainability

At this early stage, a lot of investment is going into enhancing the technology to make it more effective and universally impactful, and into changing the mindset of potential users to accept a novel approach. Initial skepticism in the minds of potential users is expected for a technology as disruptive as this one.

BIRAC support

BIRAC identified the potential in our novel concept and funded us right from the start. Its Industry Innovation Programme on Medical Electronics (IIPME) funding scheme



offered us a grant of ₹50 lakhs. This was followed by the Small Business Innovation Research Initiative (SBIRI) grant of 30 lakhs. We are now in discussions towards securing a product commercialisation plan. Apart from grant and financial support, strong processes in BIRAC and their reporting and planning support tremendously helped us in streamlining our efforts to get the maximum outcome and visibility.

Market reach & penetration strategy

The potential worldwide market size for this product is 51 million, whereas the same in India is 14 million. We are starting to reach our user base with a one-on-one approach: identifying the potential user base from deaf schools and then approaching these students and their parents through product specialists visiting them at homes. We anticipate a large sales team in the beginning, but as adoption of our product rises, this will change to primarily a downloadable format and a distance support model.

Addressing disconnect between innovation centres and workplace/end user

Innovation centres need to work in close association with actual users like clinicians. In our case, as the inventor is a clinician himself, this gap was easy to close.

AWARD

Awarded at the National Bio Entrepreneurship Competition, 2019



Stumbling blocks to a promising technology reaching users

New technologies are expensive at the beginning. Support groups like BIRAC are crucial in providing the financial backing and visibility needed for these innovations to get tested. Coordination between innovators and clinicians needs to increase as well.

Other assistive technologies at your company

See Sound Live has the potential to become for the deaf what Braille is for the blind today. Our company is only focussed on See Sound Live development and distribution. The technology needs to be further refined and has to keep pace with evolving computers and smartphones. It also needs to be developed in every language in the world. It needs to penetrate through the existing barriers in the minds of those who think that the deaf cannot speak. With See Sound Live, the old adage 'deaf and dumb' will cease to exist. We cannot afford to dilute the focus at this juncture.

Barriers to market access for Assistive Tech products

Assistive technologies have a very limited audience and user base compared to typical consumables. As such, its financial projections often do not add up very well for businesses. State and CSR funds need to pitch in. Clinical outcomes and alleviation of disability cannot be defined by cost. Millions spent on 1 per cent alleviation is also worth it. The world, governments and corporations should appreciate this. ■



Pavan Kumar

Founder-Director,
Assistive & Rehabilitation Technology Innovation LAB (ARTILAB)
Foundation

Bengaluru-based engineer Pavan Kumar believes in creating the right ecosystem for responsible innovators in India. As the founder-CEO of Workbench Projects, world's first hyperspace for hardware innovations, he has spearheaded challenges for organisations like ICRC, OnePlus, GE and Intel. He has been one of the expert panelist and jury member for Atal Tinkering Labs across India by NITI Aayog. His ARTILAB Foundation is the world's first incubator for assistive technology for PwDs funded and supported by the Department of Science and Technology.

Perspective on Indian assistive tech landscape; sector's evolution, potential

The assistive technology space is very nascent; however, the increasing penetration of technology in all aspects of our lives has provided a massive boost to the AT space. We have also seen an increased focus on technology-for-inclusion on the part of government departments like the Prime Minister's Office and the NITI Aayog, and greater activity through incubators like Social Alpha, ARTILAB and SINE. In addition, corporates like Microsoft, Google, TCS and Infinion are approaching this space not just from the perspective of inclusivity, but also as representing a vast market and a pool of untapped talent.

Having technology at its core has caused the sector to evolve quite rapidly over the last few years, involving a lot of empathy-based, tech-driven problem-solving efforts. We are seeing more numbers of students and innovators entering this space, and with India's vibrant entrepreneurial ecosystem, coupled with the similarity of market features in Latin America, Africa and South Asia, we expect to see a huge boost in the AT space in the next four to five years.

Suggestions for early-stage tech start-ups developing solutions for PwDs

In the seven years that I have been in this space, the largest challenge for entrepreneurs has always been user validation and adoption. I would urge early-stage tech start-ups to spend time on the ground and in the field,

understanding lived experiences through interactions with end users, as well as NGOs and philanthropic bodies working in this space, right from the product design phase.

It will also be important to create a product that solves fundamental problems while still allowing for customisation to align with specific requirements of individual users.

Policies or support system available for start-ups working for PwDs

The AT ecosystem is developing through the efforts of incubators like R2D2, ARTILAB and SocialAlpha, who are seeking to forge connections with governments (both state and central), NGOs and corporate entities, to ensure a strong support systems for entrepreneurs working in this space.

We have also seen a huge push from the policy side; however, the problem here lies at the implementation stage. Active promotion of universal design principles, coupled with strong audit mechanisms would go a long way in developing this space.

The reality, however, is that India has a large number of legacy spaces and institutions that see massive footfall, so the pace of change will have to be calibrated to take this into account.

Reason behind relatively limited number of assistive tech innovators

One major element that leads to a limited number of entrepreneurs entering this space is the lack of

early exposure/access to the problem statements (at the school level).

However, this does end up acting like a natural filter for innovators entering this space—many entrepreneurs that focus on work in this area have personal exposure to user challenges, which gives them an empathy lens in the process of solving.

Bottlenecks to creating sustainable demand & market access

I will reiterate here my advice to early-stage entrepreneurs: continuous engagement with users will be critical to success and this engagement must be done right from the product design stage. In that regard, forging relationships with NGOs and philanthropic organisations will be crucial to ensuring that your concept translates into a solution that actually helps solve key user problems.

Creation of sustainable assistive tech business by start-ups

Creating a for-profit enterprise would definitely be recommended as paving the way towards sustainability, as the business landscape independently pushes entrepreneurs towards creating sustainable organisations with robust individual layers and stable organisational processes, coupled with execution of the highest standard.

Ways to promote domestic & international risk capital for assistive tech sector

While this sector is largely supported through direct grants from philanthropies, CSR reforms and the government on incubators has

led to a definite shift towards a model where funding and support is provided to entrepreneurs and innovators, who in turn work on the problem solving and execution aspects of inclusivity development.

Risk capital is not a reality in the near future, given the growth rates and timelines for realising return on investment. It may not even be wholly desirable to see a sudden change in this aspect, since the push for rapid realisation of returns is often a goal not completely aligned with solving problems for the differently abled.

One aspect that could help strike a balance and works in favour of risk capital approaches is the cross-applicability of AT solutions across multiple large markets (Latin America, Asia, Africa), while another way of ensuring the same would require engagement from investors (family offices, impact investors) who are working on ecosystem-level activities, and as such, have a longer engagement/investment window in mind.

How can start-ups collaborate with NGOs?

Building relationships with NGOs in this space is absolutely critical to the success of a start-up, given that these organisations have forged strong relationships with end-users and would be able to convey fundamental needs and requirements through their experience, while also acting as channels for directly reaching end-users. In fact, the interaction between NGOs and AT start-ups forms one of the key elements that will develop the inclusivity ecosystem in general.

Successful business models/policies/financial support system in mature markets that can be replicated in India

Insurance-driven markets like Europe and North America will usually see significantly higher R&D budgets as compared to markets like Asia, Africa and Latin America. So there would be countless learning opportunities on the product side.

However, entrepreneurs in India are well placed to be pioneers when it

comes to sustainable business models, and public-private partnerships for holistic ecosystem development. This challenge should also help in attracting the best business/product minds to this space.

Of course, we should also explore, in parallel, how we can improve legislation to develop insurance-driven support for AT in India.

Suggestions to raise the reach of assistive tech products

Again, I will stress on the need for continuous engagement with users to understand their lived experiences. This will ensure that products/solutions are created through a participatory process, and the end-output is something that truly adds value to the lives of the users.

NGOs, CSR bodies, governments, incubators and the community at large can all be leveraged to establish the said access, and the same will be invaluable, right from design, to distribution, and after-sales service. ■

Prosthetic Limb Grippy



Llewellyn Dsa
Co-founder & CEO,
Bionic Hope Pvt. Ltd., Palghar

Company

During my Master's programme at IIT Patna, I came across a batchmate who had a congenital deformity where his left hand wasn't formed. I started working on a solution for him. Looking at the success of my project, Kumari Priyanka and Anil Nair, who had

helped on the project and co-founded this company with me, approached me to not limit the project to a single person. After some research, they found that this was a need of five million hand amputees across the world. Together they prepared a proposal and applied for the incubation programme at the Incubation Centre of IIT Patna. In December 2016, Robo Bionics was officially incorporated as Bionic Hope Pvt Ltd. The team wanted to ensure that the products they developed were at par with international standards; so at the design and development stage, various steps were taken to ensure that customers' needs were understood and the materials used were quality tested at every step.

Product

Our 3D-printed prosthetic limb is called Grippy, which is tested for safety and certified by India's National Accreditation Board for Testing and Calibration Laboratories (NABL). It offers a sense of touch and multi-grip control. The light-weight, affordable, battery-powered prosthesis is now available in the Indian market for people with below elbow amputation and aged 15 and above. A user can learn to

operate the device within a day and can also feel the opening, closing of the hand and be able to differentiate between a hard or soft object. It not just looks like a real hand, but also moves like a real hand.

We have filed two patents and one more is under drafting. We also have a design registration for Grippy and have also filed some trademarks.

Benefits

Users can rely on Grippy to perform day-to-day tasks that may be as simple as reading a newspaper and as complex as performing chores in the kitchen. We want users to independently perform as many tasks as possible.

Whether addresses a void

We designed Grippy from scratch taking user feedback at every step. We designed custom sensors and experimented with various mechanisms to find the right technology to work together. We crafted Grippy to overcome shortcomings like limited control over grip and motion in existing models instead of minor improvements. We also thought about the convenience of customers



AWARDS

Finalist at National Bio Entrepreneurship Competition (NBEC), 2017, organised by BIRAC and the Centre for Cellular and Molecular Platforms (CCamp) under the Department of Biotechnology

Best Indian Social Enterprise Award at Action for India Forum, Indian School of Business, Hyderabad

TiE-BIRAC Women in Entrepreneurial Research (WInER) Award, 2018

Barriers to market access for assistive tech products

- Limited professionals certified by the Rehabilitation Council of India (RCI) compared to the number of those who need such products.
- After-sales service. ■



in terms of after-sales service and local repair to a certain extent, which is a significant improvement over existing models.

Hindrances & tech challenges

Such challenges included limited suppliers in India, no Indian manufacturers for certain raw materials and lack of expertise in tackling electro-magnetic interference (EMI). When a lot of electronic components are put together, they influence each other in a non-desirable way and can even affect nearby instruments. Sometimes this happens in spite of following all design guidelines. Designing and troubleshooting EMI filters to mitigate these issues takes special expertise that is not present in the country at the moment.

Sustainability & cost-effectiveness

Though there are rivals in the Indian market, their devices are imported. By being an import substitution, we have an edge as we are manufacturing in India. Coupled with the go-to-market strategy and the manufacturing techniques involved, Grippy is sustainable, while reducing the cost by a huge margin and maintaining the features needed. To ensure the least possible down-time, Grippy has components that can be replaced at a local level; the lower down-time will ensure better user satisfaction after sales.

BIRAC support

BIRAC assisted in two areas, funding and in regulatory processes. The funding was extended right from the

ideation stage, that too as a grant-in-aid, giving entrepreneurs a chance to create grassroots innovation. BIRAC First Hub is a platform to interact with stakeholders like the Central Drugs Standard Control Organisation (CDSCO) to understand the necessary regulatory steps involved to take any product to the market.

Market penetration strategy

We are just about to launch our product in the market. As the device will be fitted by professionals, we are planning partnerships with them to penetrate the market.

Addressing disconnect between innovation centres and workplace/end user

Users can be employed to perform proof-of-concept studies and beta trials similar to software roll-outs to ensure lean but effective development right from ideation to commercialization.

Stumbling blocks to promising new technologies

Lack of awareness and backing from relevant stakeholders are two of the major problems. Indian manufacturers demand large minimum order quantity and don't provide samples for testing.

Other assistive tech being developed

We are working on another variant of the prosthetic hand and some accessories for it, and a device to assist the professional who fits the prosthesis on the user.

Sampoorti-Poorti System for Mastectomees



Dr. Pawan Mehrotra
Managing Director,
Aarna Biomedical Products
Noida, Uttar Pradesh

Company

As a medical student, I studied oncology in the United Kingdom. I returned to India in 2012 to join the Centre for Chemical Biology and Therapeutics at the National Centre for Biological Sciences, Bengaluru, a joint initiative of the University of Cambridge and the Indian Department of Biotechnology. My work revolved around discovering new therapeutic interventions for breast cancer patients.

While visiting the oncology out-patient departments, I discovered the emotional turmoil women patients experience after one or both of their breasts are removed during treatment. That led me to work on the issue of post-surgical rehabilitation of mastectomees.

Being a cancer biologist, I had no prior skills in manufacturing. But by the end of December 2013, I had

decided to come up with an affordable and accessible solution for every breast cancer patient in India who undergoes mastectomy. I resigned from my job in February 2014 and Prof. PVM Rao of IIT-Delhi helped me learn the art of manufacturing and product development.

After four years of iterative research and development, the Sampoorti-Poorti system evolved with support from BIRAC, Foundation for Innovation and Technology Transfer (FITT-IIT Delhi), the Translational Health Science and Technology Institute (THSTI) in Faridabad, Tata Trusts' Foundation for Innovation and Social Entrepreneurship (FISE)-Social Alpha, Venture Centre of National Chemical Laboratory in Pune, IIT-Kanpur; and hospitals and NGOs spread across India.

This tremendous support led to the evolution of an indigenous patented

Aarna Biomedical Products
– An Empathy Led Social Enterprise

ISO 13485:2016

The Sampoorti – Poorti System:

Restoring confidence, dignity & femininity of mastectomees

- Quality
- Affordability
- Accessibility

Sampoorti: A Mobile and Concise Trial Suitcase harbouring full assortment (different sizes) of breast prosthesis & accessories

Poorti: World's First Holistic Post-Mastectomy Kit with One Minute Product Usage Video

www.aarnabiomed.in

manufacturing process and an in-house production plant. Aarna Biomedical Products was incorporated on March 17, 2017.

Product

The Sampoorti-Poorti system was pilot-launched on January 1, 2018, after 18 months of use by patients without any reported problems. Between the launch date and March 31, 2019, the system was deployed strategically to explore and evolve the best dissemination strategy for scaling up operations across India and beyond. The Indian government, the Bill and Melinda Gates Foundation and the Wellcome Trust launched the system in March 2019 at the national level.

Sampoorti is a mobile and concise suitcase comprising of prosthesis of different sizes and pocketed bras of different sizes with prosthesis covers, patient information forms and information brochures. This allows any hospital or NGO to provide a pre-trial to the patient to determine the prosthesis size and bra size that are the most comfortable to the mastectomee.

Poorti, an user-centric post-mastectomy kit is based on light-weight pre-made silicone gel breast prosthesis (in ten different sizes and two shapes), two pocketed brassieres (in eight different sizes and two colours), two prosthesis covers, one prosthesis

holder, information and usage manual, and an outer waterproof kit that accommodates all these components discreetly. We have been granted a manufacturing process patent.

Benefits

Many breast cancer patients who lose one or both breasts have never used an appropriate solution (except cotton or foam balls) till date and some who bought an imported solution made of heavy-weight silicone struggle as it causes intense pain on the bra shoulder straps. These women are going to immensely benefit. Apart from them, females born with asymmetric or underdeveloped natural breasts, breast cancer patients who opt for reconstruction but suffer from asymmetry issues due to a collapse at the site of surgery, burn-victims and transgenders opting for gender reassignment surgery can also use the kit.

Whether addresses a void

There is a huge unmet need of affordable and holistic non-invasive solution for post-surgical prosthetic rehabilitation of mastectomees pan-India and beyond. Even in the developed world, the cost of breast prosthesis is quite high and in the developing ones, silicone breast prosthesis as a solution is still not known to most.

Hindrances & tech challenges

- **Skills:** Being a biologist with no prior product development and manufacturing skills, it was a

challenge to either learn these skills on my own or to collaborate with people who have the expertise.

- **Raw materials:** Around 80 per cent of products used in health-care in India is through imports, and therefore, raw materials required to manufacture those in India are unavailable with very few or no vendors being able to understand the technical requirements.
- **Manufacturing space and process:** Healthcare products requiring simple manufacturing processes and it was hard to find a collaborator who would first create a clean environment and subsequently start manufacturing.

Sustainability & cost-effectiveness

We offer after-sales support for Poorti and the MRP for the product has not been raised since January 1, 2018. The starting price of the complete Poorti kit is ₹4,500. The price increases by ₹250 if the size of breast prosthesis increases. The price of a full Poorti kit with accessories is less than a third of the price of the imported light-weight breast prosthesis alone.

To the best of our knowledge, we are the first movers and the only indigenous manufacturer of light-weight silicone gel breast prosthesis in India. Three Indian companies procure

heavy-weight silicone breast prosthesis from sex toy manufacturers in China, package them under their own brand names and try to sell to patients. But as the product is quite heavy, not soft as human breast tissue and durability and regulations are a major concern, these importers have not created an impact yet. The breast prosthesis imported from Europe and the United States are too expensive and are sporadically available with very limited sizes. The temporary cotton- and foam-based prosthesis are a stop-gap arrangement which women wear till the sutures have healed. Hence, we are hopeful of our product's success.

BIRAC support

BIRAC has remained as an inclusive parent over the last six years for us, helping us mature our zeal to its dissemination across various states through the BIG and the PCP schemes.

Market reach & penetration strategy

Sampoorti has allowed us to make a lot of women entrepreneurs, who provide a trial to the patient and earn an incentive in return. At present, we work together with dealers, NGOs, hospitals, physiotherapists and women entrepreneurs in more than 67 cities.

Addressing disconnect between innovation centres & workplace or end users

Making the beneficiaries an integral part of the solution development right from the beginning is always impactful. Though the geographical spread, huge cultural and socio-economic diversity and ever growing population of India presents a daunting task to connect the innovation centres with end users, one of the practical strategy to achieve this could to create

a situation to reach out to the youth in schools and colleges who would observe, catalogue and relay to a central system the unmet needs for which solutions are needed. Once such needs are assembled in a central repository, the same youth could develop a solution later with help from innovation centres, who can also help search for possible funding opportunities. The incubation centres have a very limited ground connect with the masses now.

Stumbling blocks to a new technology from reaching users

Ideation should be done with the intent to offer a user-centric, inclusive and affordable solution but before ideating the product, an important component missed out quite often is to gauge whether the developed solution has a market, and if so, what would be the tentative cost to the users and who would be the stakeholders in the deployment process. Generally, the commercial part is conceived after a product is developed and that leads to failures and disappointments. Pragmatic strategic thinking for commercialisation should come first and not merely emotional desire to develop a digital or physical solution.

Barriers to market access for assistive tech products

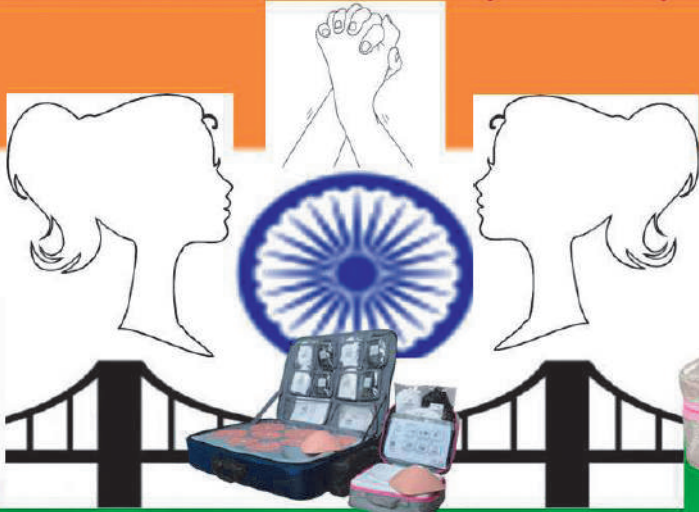
In case of AT products, affordability is a major concern coupled with the fact that margins for mainstream dealers are not as lucrative, and therefore, percolation through current market channels becomes tougher. In most situations, as the product is new, creating awareness requires ample time and initial costs before sustainability is achieved. ■

AWARDS

Awards and recognitions received from Tata Trusts, Department of Science and Technology, BIRAC, Lockheed Martin, IIM-Kolkata, IIT-Delhi and IIM-Ahmedabad

SERVE A CAUSE & EARN A VALUE

By-Women-For-Women Social Entrepreneurship Model



The Sampoorti – Poorti System:

Restoring confidence, dignity & femininity of mastectomees

Aarna Biomedical Products – A Social Enterprise
www.aarnabiomed.in



Dr. Patanjali Dev Nayar

Regional Adviser, Disability & Injury Prevention and Rehabilitation
Department of Healthier Populations and Non-communicable Diseases
WHO Regional Office for South-East Asia

Perspective on Indian assistive tech landscape, sector's evolution

India's assistive technology landscape is dynamically evolving as the country gradually gets plugged into the global scene. However, it has huge gaps. The need-demand-supply triad is heavily skewed. Most providers, barring a few, are unsure about new AT products. Manufacturers work on small scale and there is hardly any standardisation. PwDs constitute just one section that needs AT; the ageing population and those with non-communicable diseases also need such products. There are serious government efforts on this front.

Policies or support system for start-ups working for PwDs

There should not be any policy specific for AT start-ups as a separate ecosystem for them is simply not possible. India does have good policies; what is needed is an ecosystem that facilitates utilization and innovative models of distribution of AT products. Access to those who need AT ought to improve, but not only through philanthropic means. For example, mobile vans can be deployed at the municipal or panchayat levels to

collect needs and statistics of PwDs in their area and the vans can deliver AT products to them in the next trip. Why should PwDs and their family members keep chasing government agencies or NGOs for their AT needs?

Reason behind relatively limited number of assistive tech innovators

That is because of some inefficiency at the policy level as innovators need demand. Hence, a concerted effort is required by the rest of the society to match the enthusiasm of the innovators. And innovators are not necessary those found in IITs and technology institutes.

Bottlenecks to creating sustainable demand & market access

There is no bottleneck per se. There is a huge pent-up demand for quality AT products at affordable prices, but there is hardly any quality control or standard for such products.

Ways to promote domestic & international risk capital for assistive tech sector

A multi-pronged attack is needed so that users accept it as an investment

for better life instead of an expense. The demand and supply needs to be matched. Products can be subsidized using schemes like Ayushman Bharat.

Successful models and policies in mature markets that can be replicated in India

A small country like Italy has 33 centres dedicated to AT. China hosts a ten-storey building on AT products, which signals its economy of scale in the field. The social models of Nordic nations and the scientific concepts of Italy, Germany and the United Kingdom related to AT have the potential to be replicated in India to increase demand for such products.

Suggestions to raise the reach of assistive tech products

Most of the country's manufacturers in this sector need to discard the 19th century mindset. Quality manufacturing, advocacy, publicity, a mixture of philanthropy and sale through distribution channels, and conducive government schemes and missions like 'Vocal for Local' can help raise the reach of AT products. ■



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Perspective on Indian assistive tech landscape; sector's evolution, potential

The sector has certainly evolved and moved forward in the last few years. The presence of two accelerators/incubators, specifically for start-ups in this sector—Assistive Tech Foundation and Artilab Foundation—is a clear indication of the growth and maturity. There are a few start-ups like Bengaluru-based Rise Legs that are seeing commercial success and many are on the cusp of growth. I expect to see commercial success of many more in the next few years.

Suggestions for early-stage tech start-ups developing solutions for PwDs

The market size is very small for any given product in this sector. Further, in countries like the United States, every person with a disability gets an annual cash support from the government for assistive technology support. This allows start-ups in this sector an addressable market that has an ability to pay.

In India, however, most PwDs do not directly buy assistive tech solutions. It is either the government or charitable entities that buy, and hence, end-users have very little say in the solutions. So start-ups in this space need to do three things: work directly with PwDs to create solutions; look for synergies with other markets, not necessarily involving disabilities; and look for partnerships with other countries in the global South, such as Indonesia, the Philippines, Vietnam and African countries, where the technology sector is not as well developed as in India but the needs and situations for PwDs may be similar.

Reason behind relatively limited number of assistive tech innovators

Start-ups in this sector are social enterprises that cannot expect huge valuations and glamorous investments. It is a labour of passion to create and or work in such start-ups, and therefore, the limit.

Ways to promote risk capital for assistive tech sector

Traditional venture capitalists will not support this sector as this does

not promise the multiple returns that e-commerce companies offer. We need to encourage venture capital companies that invest in social enterprises.

How can start-ups collaborate with NGOs?

Start-ups can connect with organisations like Enable India, Samarathanam, etc. even at the early product development stage so that they have tie-ups with the community of PwDs.

Successful business models and systems in mature markets that can be replicated in India

This requires state and central government to have policies of direct cash disbursement to PwDs to make such models possible.

For instance, every child who is vision impaired should get a reasonable amount per year as direct cash subsidy for assistive technology. However, it is not clear if the governments have the financial resources or the mindset to make this change. ■



Perspective on Assistive Technologies

In the present age of Digital India, tech driven innovative start-ups are paving the way for affordable Assistive Technologies (AT) so that People with Disabilities (PwDs) can lead an independent life. The growing number of start-ups sensitive to the unmet needs of this section of society augurs well for the growth of the Assistive Technology ecosystem in the country. There is a high unmet need for Assistive Technologies which are affordable, innovative, assistive, adaptive, to develop rehabilitative devices/solutions for PwDs and elderly people, says **Ms. Anju Bhalla, Managing Director, BIRAC.**

BIRAC promotes entrepreneurs, start-ups and SMEs across the value chain to undertake strategic translational research to develop innovative products and technologies. Technology driven solutions can steer the change for societal well-being impacting quality of lives. BIRAC in association with Social Alpha and Mphasis had launched the “Quest for Assistive Technologies” to identify, handhold and deploy Assistive Technology solutions for the deserving ones. The 14 winning solutions included assistive technologies in speech and hearing impairment, locomotor disability, visual impairment and intellectual disability for children and adults. It is an exemplar case of strategic Public Private Partnership where different stakeholders BIRAC (Govt agency), Social Alpha (philanthropic organization) and Mphasis (industry) have joined hands in support to potentially scaling Assistive Technologies from start-ups, said **Dr. Manish Diwan, Head, Strategic Partnerships and Entrepreneurship Development, BIRAC.** Such initiatives will encourage national and international stakeholders to join hands in delivering assistive technologies at scale.

This *i2M: Idea to Market* booklet features detailed information about these innovative products developed by the BIRAC-Social Alpha-Mphasis supported start-ups. This publication recognizes the enabling efforts of the Department of Biotechnology and its PSU BIRAC to address ecosystem gaps and unmet needs.

Our heartiest congratulations to the wonderful effort made by these start-ups. ■

The Way Forward

Most experts agree that the assistive technology landscape in India is fragmented and nascent. This leads to duplication of efforts as innovators work towards finding the solution of similar problems. But it is evidently clear that interest by start-ups in developing new technologies in this field is picking momentum. There is a significant addressable market—in the form of Persons with Disabilities (PwDs)—for these technologies and that is growing at a decent pace. There is ample scope of commercial success for innovators and capital appreciation for investors.

But this heightened interest needs to be properly channelised through collaboration between innovators, government departments, research institutes, NGOs and other agencies. The country indeed has the potential to turn a world leader in Assistive Technologies (AT). With increased cooperation with academia, engineering and other allied health sectors, a good ecosystem can be nurtured for the sub-sector's growth. Bringing in private investment in the sector will make businesses economically viable as innovation-centric R&D is capital intensive.

Innovation

Many a times, innovators do not engage in proper needs analysis and end up creating products that do not address PwDs' primary requirements. Products created thus are often expensive and are unaffordable without government support and philanthropy. Proper effort needs to be put in to ensure products are affordable by wider sections of the society. Over-focus on go-to market at times is an issue as well.

The assistive technology sub-sector should be promoted to attract more innovators. Collaboration among innovators and between innovators and domain experts like prosthetist and orthotists are essential to develop more meaningful products. This will ensure innovations that better address needs and also take care of initial capital requirements

for bringing a product to market. Support through sound quality control and timely clinical trials are crucial as well.

The spirit and enthusiasm among innovators in this field should be encouraged and government agencies should ensure products hit the market on a regular basis backed by appropriate marketing efforts. Designing products targeting markets in multiple geographical regions can be of great advantage.

Support agencies

Many interesting AT projects only go till the pilot stage as the innovators are only researchers. Government agencies should make all efforts to smoothen the journey of an innovator to an entrepreneur, which has been quite tough in the past. Support already exists in the form of capital, grants, favourable policies and distribution assistance. Further support can be extended through testing and validation of new technologies. All parties involved should look at it beyond CSR responsibilities.

The role of NGOs is crucial as they can help the businesses grow in a big way. They connect start-ups with customers and are aware of exact requirements of PwDs. However, innovators teaming up with NGOs without proper due diligence may prove detrimental.

In the last few years, India has seen several annual contests and competitions engaging innovators—both by government departments as well as private entities—which reward indigenous assistive technologies, and that has had an efficacious impact on start-ups by boosting their confidence.

Economics & commercial viability

Most PwDs in India are not properly educated and lack regular employment avenues. As a result, they are in no position to purchase AT devices or products. Creating a market is indeed a tough task when the purchasing power of end consumers is extremely limited and start-ups

have to bank on philanthropy or government support to distribute their products.

But philanthropy is not scalable. Users are not interested in maintenance and after-sales service as they can easily get another piece of the product free. That is also one of the reasons why the distribution network for AT products in the country is limited to pockets and the supply chain has almost vanished.

No innovation can survive without competition. While competing in a market where products are distributed free, survival of start-ups turns tough at times. There is no major manufacturing hub for AT products, which are produced mostly as a side business by companies.

Generating risk capital is a key to ensure growth in this sector. This is only possible by building proper business cases. More market studies may be conducted to highlight the growth potential in this sub-sector, especially from a commercial viewpoint.

Successful global models thriving on partnership can be replicated. In the long-term, insurance coverage for such products and bank loans to buy these are probable solutions as well.

Tailpiece

Government departments like BIRAC are right on track, encouraging more AT innovators. This impetus needs to continue to ensure a constant flow of ideas. Start-ups should also think beyond technology and explore marketing, sales and distribution. Decentralising rehabilitation services and integrating those in mainstream healthcare will help raise its reach. Collecting statistics on PwDs and their requirements also needs to be bolstered.

India may take cues from the financial support models for PwDs in the United Kingdom, the United States and Australia and the social models of the Nordic nations to improve the assistive technology scenario. ■

Notes

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