global POLICY

GP-ORF Series

Pushing the Boundaries of Indian Tech
Women on the Frontlines

EDITED BY

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WILEY-BLACKWELL

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EDITORS' NOTE

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Technology is an integral part of India's socio-economic growth story. The country houses the third largest startup ecosystem in the world, after the US and China. Over 50,000 startups have created north of US$500 billion in value over the last decade (1). Technology has powered this trajectory, particularly with the development of the multilayered technology network IndiaStack, which has led to unprecedented financial and digital inclusion. India is witnessing two pivotal women-centric phenomena at this time—one, there is an unparalleled inclusion of women in the Indian economy, boosted by technology platforms; and two, women are increasingly pushing the boundaries of technology development. This Global Policy-ORF report on 'Women on the Frontlines' showcases the latter.

When India's Mangalyaan mission was launched a few years ago, the iconic image that captured millions of hearts was that of the scientists behind the achievement—a group of women, in saris with flowers in their hair, celebrating the launch. This is emblematic of many women in science and technology today, particularly in India—they are pushing the boundaries in their respective fields, but often from behind the scenes. It is worthy to note that Indian women enter STEM fields in far greater numbers than in peer countries. Women now make up 34 percent of the IT workforce in India. We are also at 50:50 gender parity rate in STEM graduates (2). This is far higher than in Europe (18 percent) and the US (about 25 percent) (3). India's higher education system also reflects this directional movement; last year for the first time, women's gross enrolment ratio (26.4) exceeded that of men (26.3) (4). Indian women are rising with clear aspirations.

This report aims to showcase women on the frontlines of technology development and deployment and to highlight both their professional achievements and their individual stories. We first meet four trailblazers, who started working in technology when it was a relatively new field in India and, in a time that was far less welcoming to women. We then showcase the leaders of tomorrow, women who started their journeys more recently but are already seeing success across a range of ventures.

The contribution of the trailblazers has been invaluable in building India's tech ecosystem. Kiran Mazumdar-Shaw, founder, chairperson and managing director of Biocon Ltd. and one of India's few self-made women billionaires, has fearlessly steered her company into a global pioneer in the biopharmaceutical space. Nivruti Rai, country head of Intel India, has risen through the ranks of one of the world's foremost technology companies and brings her multi-dimensional product experience to pushing the boundaries of Indian research and development. Dr Renu Swarup, Secretary of the Department of Biotechnology (Ministry of Science and Technology, Government of India), straddles the critical juncture of science and governance and has been crucial in setting up a pipeline of early-stage high-risk scientific development ventures in the country. Vani Kola, founder and managing director of Kalaari Capital, has pioneered the role and deployment of early-stage risk capital in the development of indigenous technologies. These trailblazers are role models to the millions who have been inspired to follow them into various technology fields.

Our 'Women on the Frontlines' section features women who have founded and built companies at the cutting-edge of technology across a range of segments—finance, data analytics, media, scientific innovation and education. They have brought technical and management expertise to bear on a range of problems, using either digital platforms or deep technology for their growth and value proposition.

In the field of financial technology, India has emerged a leader of innovation. The entrepreneurs who have contributed to the 'Financial Technology' section have all developed proprietary fintech platforms to solve specific market gaps. Mabel Chacko and Deena Jacob from Open, the world's largest SME-focused neo-banking platform, help over 500,000 small enterprises resolve challenges in accessing and managing finances. Jayalakshmi Manohar, of Streak, brings state of the art technology to the average retail investor, earlier available only to large institutional investors. Chaitra Chidanand, formerly of Simpl, created a platform to provide temporary credit to users conducting purchases with cutting-edge machine learning technology to manage credit risks. A common theme with our four features is the use of technology to assist previously underserved groups.

Our 'Data Platforms at the Edge' section features three women who are harnessing the infinite potential of data platforms. Infibeam, co-founded by Neeru Sharma, uses data platforms across a range of services including online retailing, digital payments, e-commerce, software and internet services. Neha Singh, of Tracxn, deploys data intelligence and research at scale to help venture capitalists and institutional investors identify potential areas of investment. Ashwini Asokan, of Mad Street

Den, is working to build generalised artificial intelligence at scale, with use cases across a range of industries starting with retail. An underlying theme in this section is the deployment of extensive tech platforms to develop strong value propositions that address a variety of market gaps.

Internet penetration has risen exponentially in India over the past decade; the average Indian today consumes 11GB of data per month (5). This has fundamentally changed the way Indians access media, creating enormous challenges to the advertiser-based models of traditional media. Our 'Media and Content' section showcases entrepreneurs who have taken advantage of this trend to build thriving digital-only media platforms. Shradha Sharma of YourStory launched her platform to tell the stories of aspiring changemakers and entrepreneurs, with a distinct lens on women via the HerStory platform. Her focus, to a great extent, matches that of this series—she wanted to give a voice to rising stars whose achievements merited greater visibility. Aditi Shrivastava from Pocket Aces has fundamentally altered India's digital entertainment space, with a mission of 'alleviating boredom'. These entrepreneurs use data-backed insights and digital platforms to connect to and create content for their ever-growing audiences.

Our 'Science at the Frontier' features have been chosen with a strong focus on sustainability. The innovation of the last century has brought us the technologies of today, but also threaten our planet. The COVID-19 crisis has demonstrated the fragile relationship between nature and humanity, and the high costs when this relationship loses balances. The biggest shift humanity will need to make in the coming decades is to clean sources of energy, and Sri Sailaja Nori and Sowmya Balendiran of Sea6 Energy are among those leading this charge. Their company uses micro-algae to create ethanol and natural gas, reducing reliance on carbon-intensive forms of energy. Ezhil Subbian's String Bio creates alternatives to products from biodegradable plastic to high-performance polymers for stents and sutures, creating circular value chains for organic waste, methane and plastic. Kavitha Sairam is founder of FIB-SOL, a company that provides solutions to two areas that are ripe for disruption—agriculture and health. Their nanofibre applications help fertilize large tracts of farmland with small quantities of fertilizer, without degrading soil quality.

Our last segment looks at 'Education Technology', which has gained a considerable amount of attention as children are forced to study remotely during the pandemic-induced lockdowns. BYJU's, co-founded by Divya Gokulnath, has become a household name as the world's most highly valued edtech company. Their aim of making children fall in love with learning is particularly relevant today as we hurtle towards an uncertain future of work. Priyanka

Subramanian, of Uable, focuses on the 6-14 age group, one of the first generations in the world born as digital natives. While online learning can often be a lonely experience, they meet this challenge through peer learning environments to ensure every learner discovers and develops their potential. Charu Noheria, of Practically, works to use online platforms to deliver experiential learning. They use new technologies like simulations as well as augmented and virtual reality to provide interactive experiences, successfully bridging the gap between digital and real-life learning. High-quality, affordable and accessible education will remain imperative even after the pandemic, to ensure that India's young population, the largest in the world, is equipped to enter the workforce as productive members of society. These three entrepreneurs are redefining the way our youth is educated.

Our primary thought, as we put this report into the world, is how inspiring it has been to read the stories of these incredible women and the work they have done. While we have just scratched the surface, we hope this selection of essays and conversations will provide a view into the myriad solutions technology has to offer in a variety of fields, and the brilliant women who have taken transformational steps in this direction.

Nisha Holla and Annapurna Mitra

About the Editors

Nisha Holla is a writer, researcher, and engineer. She is the Technology Fellow at the Centre for Cellular and Molecular Platforms, Bengaluru. Nisha was previously co-founder of Biomoneta Research, designing technology for the prevention of the spread of infectious diseases. Prior to that, she was based in the San Francisco Bay Area working at the cutting edge of hardware product and process development at Applied Materials and Bloom Energy. Nisha holds a Master's degree in Chemical Engineering from Carnegie Mellon University.

Nisha writes about ideas and shifts at the intersection of technology, economics, and policy. She has co-authored numerous articles and several reports on human capital development in India, comparative studies of India's states' economic and demographic growth, multiple facets of India's technology readiness, and India's response to the COVID-19 pandemic. As Consulting Editor at YourStory, Nisha produced India's first report surveying the country's deep science innovation ecosystem.

Annapurna Mitra is a Fellow at ORF. She heads the Green Transitions Initiative at Observer Research Foundation. She has earlier worked on economic diplomacy—first, with the G20 team in the International Economic Relations Division at the Indian Ministry of Finance, and then as Deputy Head of Economics at the British High Commission in Delhi. Her doctoral research at the Graduate Institute of International and Development Studies, Geneva, focused on macroeconomic policy, specifically looking at how federal institutions and political incentives interact to create suboptimal fiscal outcomes for Indian states.

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PERSPECTIVES FROM THE TRAILBLAZERS

"If your actions inspire others to dream more, learn more, do more and become more,
you are a leader." — John Quincy Adams

Data-Centric Innovation and Digitalisation Will Catalyse India's Growth

Nivruti Rai
*Vice President & Country Head (India)
Intel Corporation*

India is transforming. Technology has been the key cause of this tectonic shift across critical sectors like healthcare, education, agriculture, manufacturing and retail, with an explosion of smart and connected devices, robust applications and use cases. This is being powered by a surge in data-centric innovations that harness the power of data through leading technology solutions based on compute, storage and memory. There are tremendous opportunities to leverage the power of technology to enrich the lives of people, optimise businesses and boost a country's progress.

This sets a compelling stage as India forges ahead to become a trillion-dollar digital economy by 2025. India is a recognised technology powerhouse—it has a rapidly growing market of digital consumers, with over 500 million Internet users; the world's largest digital identity programme (Aadhaar), with over 1.2 billion people enrolled (1); and a thriving e-payment ecosystem, with an average of over 1 billion unified payment interface transactions in a month (2). India's IT industry generates US$191 billion in revenues, with a strong talent base of 4.5 million engineers (3); the majority of the top 10 global systems integrators are based out of India; and there are over 9000 tech startups, 1600 of which are in the deep technology space (4), thriving in the country.

Moreover, India's vast population is the biggest catalyst for tech adoption. Its immense appetite for digital services makes it incumbent on the tech ecosystem to develop solutions that are affordable, scalable and profitable.

The COVID-19 pandemic and the new geopolitical scenario have remarkably accelerated the adoption and innovative implementation of these vital technologies. We are witnessing unprecedented momentum in the adoption of remote collaboration tools and digital access to services across industries. Every segment is getting digitalised to remain relevant and keep up with the times.

It is exciting to see this rigour and energy for innovation and technology advancement. As this journey intensifies, there are several technologies that will be crucial for India to attain its trillion-dollar digital economy goal.

Population-scale Artificial Intelligence (AI) to catapult digital transformation

AI has been around since the 1950s, but is only now becoming ubiquitous because of the fusion of two vital things—the vast amount of data available today, and the availability of compute power and memory, which can make sense of that data and help us derive value from it. We are now at a defining point in history. As we enter the age of AI, India has an opportunity to lead and leverage our unique strengths of technology, data volume, data diversity and talent.

With the potential for population-scale AI adoption, India is in a unique position to maximise the opportunity to drive world-class technology advancement and innovation, focus on human-centric applications and democratise AI for the world.

According to the NASSCOM report 'Implications of AI on the Indian Economy', on average, a unit increase in AI intensity by companies that use AI can contribute US$67.25 billion—or 2.5 percent of India's GDP—to the Indian economy in the near term (5).

Next-generation communications: 5G infrastructure essential for Digital India

5G is the enabler for distributed computing, to make compute available where data is created. It goes far beyond smartphones to connect billions of smart devices. 5G converges the worlds of computing and communications to create virtually unlimited compute power from the cloud to the network to the edge.

India has an opportunity to lead in 5G technology. India's digital economy needs smart, robust and affordable systems that can support the data requirements of the 5G ecosystem. In India, this new frontier in computing capability will be driven by an ecosystem of open source innovation. Disruption will be generated through partnerships between India's innovators and developers, anchored by advances in academic and research labs.

The government needs to look at connectivity just as it sees electricity, roads and water—as part of our social and economic fabric. Therefore, it is important to focus on rural connectivity solutions and driving growth in rural areas, as this will enable access to the global economy. Research indicates that "*an 10-percent average increase in mobile broadband adoption causes a 0.6 percent to 2.8 percent increase in economic growth, depending on the model specifications (6).*"

Industry 4.0: Catalysing transformation through rapid automation

India needs to be at the forefront of driving industry 4.0 for its competitive advantage. Digitalisation is at the heart of industry 4.0. This will require innovations and the advancement of key technologies like machine vision, robotics, smart energy infrastructure and emerging edge compute applications. In addition, industry 4.0 has a huge potential to catalyse and promote inclusive and sustainable industrial development in the country. Given India's thrust on `Make in India', it's important for us to adopt innovative and sustainable manufacturing practices and techniques.

As these technologies mature and create a wave of innovations, their applications and use cases will transform critical sectors for India and the world in general.

Healthcare: In the healthcare space, technology has enabled a wide spectrum of applications like telemedicine, medical imaging, enhanced diagnostics, drug discovery and hospital workflow efficiency. The internet of things (IoT) and wearables that can diagnose heart conditions, sensors that monitor epilepsy attacks and glucose monitors that send data straight to smartphones are enabling better self-care. As technological innovations integrate with healthcare delivery, they will enable scale and lower costs, driving up adoption.

During the current pandemic, we are seeing a significant rise in telemedicine and tele-consultation, democratising access to timely, affordable and quality healthcare, particularly for people from remote and rural parts of the country.

Technology is also playing a role in predicting and managing outbreaks using population-scale data and analytics. For instance, in a multi-disciplinary collaboration, Intel India, the Council of Scientific and Industrial Research and the Hyderabad-based International Institute of Information Technology are working to help achieve faster and less expensive COVID-19 testing and coronavirus genome sequencing to understand epidemiology and AI-based risk stratification for patients with comorbidities.

Agriculture: About 50 percent of India's population depends on the agricultural economy where technology can play an important role in transforming the sector.

Intelligent edge-based technologies, data analytics, robots and drones can provide farmers with real-time information on crops, soil deterioration, geographical factors and pest vulnerability, thereby improving farm yield.

It is encouraging to see technology being leveraged across the value chain, from farming to distribution, delivery and consumption of the produce. There will be continued traction in this area.

Education: The education sector has been one of the fastest adopters of technology, with an exponential growth in remote learning, smart classrooms, and personalised and immersive learning and tools to design learning activities. The e-learning ecosystem will become mainstream and empower the masses with access to quality content and instructors. It is also important to build a complete end-to-end solution in the education space so that children in rural areas do not miss out on education.

Technology manufacturing ecosystem: Opening a new vista for India's global competitiveness

With India's focus on making the country a global manufacturing hub, technology manufacturing will become an essential pillar of such aspiration. Electronics and semiconductors touch every aspect of our lives today, including industrial, healthcare, retail, communications and governance, and will play a major role in cloud, IoT, AI, autonomous driving and other disruptive

segments in the future. It is estimated that by 2025, India will be one of the largest electronics markets in the world, valued at US$400 billion (7).

Given the country's focus on self-reliance, it is imperative for India to develop a robust semiconductor manufacturing ecosystem by leveraging its strengths in design, digital consumption and skills.

Women in Technology: Inclusion is critical for innovation

As emerging technologies like AI, machine learning, cloud, intelligent edge and 5G are transforming our lives and work, real positive impact can only be achieved when these solutions are designed, developed and applied by a diverse pool of innovators and developers. In this context, the role of women and augmenting gender diversity becomes vital.

At this juncture, when India focuses on attaining sustained high growth, it is essential for the country to accelerate inclusive participation of women in the workplace. India has a big opportunity to boost GDP by advancing women's equality—adding US$770 billion to the GDP by 2025 (8)—but this will require comprehensive change.

While there have been several interventions made in earnest to bridge the gender diversity gaps, it requires sustained and concerted efforts to have the desired impact. In this endeavour, collaboration between the government, industry and academia is key to making quick progress towards the equal participation of women at all levels of the workplace and economy.

Intel India's commitment to accelerate innovation and technology advancement in the country

Intel India has been an integral part of India's digital transformation and innovation journey. India is home to Intel's largest design center outside the US, with state-of-the-art design facilities in Bengaluru and Hyderabad. Intel has invested over US$6 billion in India to date and continues to expand its research and development and innovation footprint in the country.

Intel India has contributed significantly to Intel's technology and product leadership with its design centres engaged in cutting-edge engineering work in the areas of System on a chip (SoC) design, 5G networks, graphics, software and platform for the cloud/data center, client and IoT markets involving advanced technology areas like AI, 5G and autonomous systems. Intel has been working with the vibrant technology ecosystem in the country and is committed to accelerate innovation, research, technology advancement and adoption to enrich the lives of the people.

India's strength lies in its large population, growing economy, pace of digital adoption and core tech competencies supported by a robust tech ecosystem, and a burgeoning innovation and entrepreneurship environment. The need of the hour is for the ecosystem comprising of the industry, startups, academia and the government to collaborate and work together to develop solutions to unleash the potential of data-driven technologies and transform business and society for the better. It requires disruptive innovations, compelling business models and use cases, breakthrough research, intellectual property and conducive policies geared towards the seamless creation and adoption of emerging tech-based solutions. These efforts will lead to the advancement of AI, machine learning, cloud, 5G and other technologies, and accelerate the digital transformation of India and the world. India should seize this opportunity to lead the next wave of innovation.

Author bio

Nivruti Rai is vice president in the Data Platforms Group (DPG) and Country Head Intel India at Intel Corporation. Based in Bengaluru, she provides overall engineering and business unit leadership and leads operations for the site, driving innovation, cross-group efficiencies and execution for engineering teams delivering global products and roadmaps. She also leads engagements with national and local governments and policymakers, as well as collaboration with ecosystem players to enable innovation and entrepreneurship.

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The Challenges and Opportunities of Innovating in India

Kiran Mazumdar-Shaw
*Founder and Executive Chairper-
son
Biocon Ltd*

I started my company Biocon in 1978 as the country's first biotech startup in an era where innovation and entrepreneurship were unheard of. Biocon began its journey as a garage startup with a total of three employees, including myself. Today, we are an innovation-led global biopharmaceuticals company that is catering to the unmet global need for affordable life-saving medicines.

Besides making a huge impact on global healthcare, Biocon has, over the years, created over 12,000 direct jobs besides having a multiplier effect on employment through the several ancillary businesses it relies on or supports.

Just as Biocon pioneered biotech in India, Infosys sowed the seeds of India's US$180 billion information technology industry that employs over four million people directly and has created 12 million indirect jobs. The industry today contributes as much as eight percent to the country's GDP.

Companies like Biocon and Infosys have demonstrated how unleashing the power of entrepreneurship and innovation can bring multiple benefits to the country and usher in a better life for millions of Indians.

Incentivising innovation and intellectual property (IP) creation is important for India's future growth prospects. Enabling entrepreneurs to propel ideas into sustainable businesses will add value to our economy in the long run and help the country achieve self-reliance, thus realising Prime Minister Narendra Modi's dream of an 'Atmanirbhar Bharat.'

The importance of encouraging innovation

In India, there is a lot of talk about 'innovation.' But 'Made in India' innovations are rarely discussed, leave alone celebrated.

In the US, Moderna Therapeutics recently initiated Phase III clinical trials for its promising coronavirus vaccine candidate and is one step away from bringing the product to the public. Moderna took its vaccine from the lab in Cambridge, Massachusetts, to human trials in a record 63 days. This was possible because Moderna's candidate was part of Operation Warp Speed, the US government project led by the Department of Health and Human Services.

The fact that Moderna is being feted by the US president himself speaks a lot about how innovation is respected and encouraged in the country. It also explains why the US consistently ranks first worldwide in cutting edge innovation.

Contrast this to the experience of Bugworks Research, incubated at the Centre for Cellular and Molecular Platforms (C-CAMP), Bengaluru, with support from the Karnataka government and the Department of Biotechnology-Biotechnology Industry Research Assistance Council (DBT-BIRAC). Bugworks is among the few companies

worldwide working on addressing a big unmet need of finding solutions to the growing global problem of antimicrobial resistance, which has serious implications for global health and the world economy.

Bacterial pandemics can be as deadly as COVID-19-like viral pandemics and result in millions of deaths globally. Yet, Bugworks has had to look outside of India for funds to advance its pipeline of experimental therapies. The latest round of funding amounting to US$7.5 million came from a global investment syndicate led by the University of Tokyo Edge Capital, Japan; Global Brain Corporation, Japan; and Acquipharma Holdings, South Africa.

The lack of funding support in the country forces innovators in India to park their IP rights outside the country. As a result, India continues to languish behind peers in the Global Innovation Index; we ranked 52nd compared to China's 14th ranking on the index in 2019.

India needs to do more if we are to retain IP within our borders and derive value from our innovations by monetising them at a global level.

But first, we must build the credibility of Indian innovation within our borders and convince people that the quality of research done in India is at par with the best in the world.

The missing link

While India has the scientific talent, we do not have the deep pockets and the enabling ecosystem that drives most of the innovation in the West. Often, we end up doing innovative research for global pharma companies as contract research service providers. We do not aim for breakthrough innovation because this kind of innovation does not get due recognition at home.

This mindset is reflected in the fact that India spends less than one percent of its GDP on research and development, lower than most of its global peers.

Also, investors in India prefer predictable, imitative business models and me-too products, where they have the visibility of assured returns.

On the other hand, business models that are truly innovative, first of its kind, and thus untested, find no takers among the investor community here. Real innovation has an inherent element of high risk, which Indians are averse to. As a result, you do not see people in India investing in real innovation.

Take biotech for instance. Most biotech companies in India operate in the low-risk services and generic diagnostics, vaccines and therapeutics space. The ones that take the risky,

time-consuming journey of bringing breakthrough medical innovation from the lab to market—like Biocon—are ignored.

Today, neither venture capitalists (VCs) nor the market value innovation in India.

Biotech startups do not even show up on the radars of venture funds. In fact, it is the Indian government that is basically playing the role of a venture fund for the biotech industry. The government has come forward to provide seed capital and risk capital. It is investing in startups and funding their efforts to take forward their ideas to the proof-of-concept stage and beyond.

But even at the proof-of-concept stage and beyond, where venture funds usually step in with 'accelerator funding', nobody from the private sphere is ready to come forward. As a result, many promising startups doing innovative research get stunted.

Venture capital funds are not comfortable investing in innovation in India because there is no attractive exit route for them. Many VCs will invest in India if they can cash out of their start-up investments via the IPO route. However, exiting via the capital market route is uncommon in India. The last Indian start-up to list on the Nasdaq was MakeMyTrip in 2010.

What India needs

In today's knowledge-driven economy, innovation is the primary driver of progress. India's ability to generate wealth and create social good will come to naught unless we monetise innovative ideas by unshackling our entrepreneurial spirit. For innovation to flourish, ideas must be funded and taken to market. Without capital, even the most transformative ideas can die before they take flight. Until we are able to create a funding-financing ecosystem, innovation in India will continue to be a far-fetched dream.

What India needs is a national innovation ecosystem that puts in place a financing cycle—academia generating ideas, especially those based on science and technology, which are incubated to proof of concept through government-sponsored seed and incubation funding and then taken to market through business intervention backed by venture funding.

Ease of accessing a market, both primary and secondary, and being able to raise capital with greater flexibility would spur innovation and unleash an entrepreneurial avalanche that would transform the pace of value-added growth in the Indian economy.

Though there is a lot of good innovation being done by women scientists in the country, we do not see them making a mark globally because they are constantly thwarted by an ecosystem that neither appreciates nor encourages breakthrough innovation.

Conclusion

Today, a large reservoir of entrepreneurial energy in India is waiting to be tapped. It is by investing in breakthrough ideas and embracing entrepreneurship as an economic model of growth that India will be able to unleash the power of innovation to ensure a better life for its billion-plus citizens.

The government must enable and support innovative startups and businesses that think locally but have the potential to make enormous global impact. By encouraging technopreneurs to grow from small and medium enterprises to large industrial scale operations, India will be able to create a compelling opportunity to take innovative ideas to global markets. In doing so, we will be able to garner a large share of the global value chain and combine both 'Make in India' and 'Innovate in India' to deliver an Atmanirbhar Bharat.

Author bio

Kiran Mazumdar-Shaw is a pioneering biotech entrepreneur, a healthcare visionary, a global influencer and a passionate philanthropist. She is a pioneer of India's biotech industry and founder of Biocon.

She is the proud recipient of two of India's highest civilian honours, the Padma Shri (1989) and the Padma Bhushan (2005). She was also honoured with the Order of Australia, Australia's Highest Civilian Honour in January 2020. In 2016, she was conferred with the highest French distinction - Knight of the Legion of Honour.

Transforming the Biotech Innovation Ecosystem

Renu Swarup
Secretary
Department of Biotechnology,
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The Department of Biotechnology (DBT) in India's Ministry of Science and Technology, established in 1986 and among the first dedicated biotechnology departments set up by any government, has been a catalyst in spearheading innovative solutions for developmental challenges. Biotechnology today has played a major role in impacting food and agriculture, nutrition, healthcare, the environment and industrial growth. As the field has progressed, DBT has made significant strides and aided in the economic and social growth of the country. From research spanning prevention and cure for major diseases, to addressing the challenges of improved agriculture productivity, to developing innovative solutions for national nutrition needs and a clean environment, DBT is leading the way for path-breaking biotechnological research.

Since its inception, DBT has been committed to delivering solutions for societal challenges with a focus on 'Make in India.' Today, as we are positioned from discovery research to translational research, from academia to startups, from institutional collaboration to knowledge translational clusters; DBT has transformed the scientific innovation spectrum in India.

Over the last three decades, DBT has created a very strong research and translation ecosystem across the country and has built strong foundations, leveraging the strength of national and international partnerships. With more than 15,000 scientists and 800 institutes and laboratories supported, DBT supports nearly 10,000 biotechnology research fellows and students annually. World class state of the art infrastructure has been created, which through the DBT's SAHAJ scheme has now been made accessible to all researchers and startups to take research and innovation across the country. Skill Vigyan life science and biotechnology centres have helped build an employable skilled human resource base.

DBT has also made significant contributions by aligning its work to the national growth agenda and developing innovative solutions for the national missions of Swasth Bharat, Ayushman Bharat, Swatch Bharat, Poshaan Abhiyan, Start-up India, Make in India and Skill India. Academic and industry experts have successfully delivered to the country.

The Biotechnology Industry Research Assistance Council (BIRAC) was set up to promote and nurture a vibrant startup and entrepreneurial ecosystem. BIRAC aims to foster excellence while supporting bio-innovations for societal benefit. Through an exponential learning curve in our short history, we have been able to consolidate the efforts to support competitive funding in diverse areas of biotechnology that have become a benchmark in the country. Through various funding programmes, we have noticed that there has been a significant boost to discovery research and a shift to product development, an area we wish to build deeper roots in so that the benefits of innovation-driven research reaches all. More than 1000 startups and entrepreneurs with be supported under BIRAC.

To take scientific research from the laboratory to the end user, the DBT has built an

ecosystem that allows for seamless movement of research from the translation phase to commercialisation. The 16 institutions, four bioclusters, two public sector undertakings and over 5000 extramural research projects have contributed to this. We have seen a growing trend over these years of moving from single-investigator to multi-investigator projects, from single institute to multi institute projects, and from only academia research to industry-academia innovation research and translation. New institutional partnerships and governance models have emerged.

It is imperative that we do not conflate a self-reliant India with a self-centred India. International cooperation and collaboration are at the core of self-reliance. India's progress will undoubtedly contribute to global progress. The DBT and BIRAC have epitomised this value by initiating multiple collaborative research and development programmes with several countries and philanthropic organisations in diverse areas of biotechnology.

As the world looks for quick solutions to meet the huge healthcare challenges exposed by the COVID-19 pandemic, our effort is to ensure that our innovations continue to focus on scalability, sustainability and replicability. The integration of new and emerging technologies, linking biological science with data science, clinical research and engineering sciences, is the way forward to prepare to meet our ambitious target of achieving a US$150 billion bioeconomy by 2025 and to India becoming a US$100 billion biomanufacturing hub.

Moving forward, our challenge is not just to strengthen the research and translation base but to ensure sustainability and scalability. The DBT has consistently brought to the fore the importance of science in all walks of life and has integrated innovation with national development. It has promoted science and technology as a way of thinking rather than a siloed field of work and envisions to continue to do so, and be a critical part of India's growth story.

As we prepare ourselves for a new world, our focus must be on the importance of indigenous research and development of impact-driven innovation. This is key to our march towards an '*Atmanirbhar Bharat*'.

Author bio

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A Fellow of the National Academy of Sciences (NASI) India, A Life Member of Trust for Advancement of Agricultural Sciences (TAAS) and a Member of the Organization for Women in Science for the Developing World (OWSD), she was awarded the 'BioSpectrum Person of the Year Award' in 2012, 'National Entrepreneurship Awards 2017', TiE WomENABLER Award 2018, 'Dr. P. Sheel Memorial Lecture Award 2018' by NASI and the TWAS Regional Office Prize on Science Diplomacy in 2018. She has been awarded the Agriculture Research Leadership Award 2019.

Technology as an Enabler for Transformation

Vani Kola
Founder and Managing Director
Kalaari Capital

When I was asked to write this keynote on the current Indian startup ecosystem for women in technology, my mind went back not to the recent debates on diversity and gender, but to a woman I had always admired—Sarojini Naidu. I had been rereading about her life. We know of Naidu as a poet and nationalist, but she was also an ardent feminist. She championed the cause of female suffrage and fought against child marriage, bigamy, *sati* (widow immolation) and for women's education during tumultuous times. Before Naidu, Savitrabai Phule had defined a path, opening a school for girls in Pune, becoming India's first woman educator.

I studied in one of the first schools for girls in Hyderabad established in 1928 by the visionary Madapati Hanumantha Rao, who was a staunch believer in women's education. I had a wonderful education and still cherish the values I learnt there, values that I see reflected in someone like Vijayalakshmi Pandit, who was the first woman to be president of the UN General Assembly, one of India's first women parliamentarians and a political stalwart known for her diplomacy.

None of these people were technology stalwarts, and that's only because their wide-ranging accomplishments were in tune with what society needed at that time. They showed how the vision of even one or two people could have a long-lasting impact. They may have led disparate lives, but they are similar in the fabric of leadership they weaved, and how they pushed the boundaries of innovation in their own ways.

This is like how I view technology. For me, technology is not the goal nor the end result. Technology is an enabler. It provides the means to create and make a difference, which ultimately brings lasting progress and radical transformation. India's strong tradition of powerful leaders has always given me inspiration and strength, making me believe that despite the many barriers, there are ways to break them.

Education and technology have always closely interlinked for me. Growing up, my high school math teacher inspired me to pursue mathematics. I followed this up by studying engineering and computer science, which came naturally to me. This early education enabled me to move to Silicon Valley to engage with cutting edge innovations and technology. Eventually, this led to my initial forays into entrepreneurship. Later, of course, the circle led me back to India and venture capital as a way to engage with my many interests, including being part of the New India story, entrepreneurship, creating economic impact through inclusion and driving job creation.

There was a time when India was merely a back-office for the rest of the world. But in less than a decade, the Indian tech and startup ecosystem has shed that yoke to become the third largest startup hub in the world, behind only the US and China. In the next decade, India can emerge as an innovation hub setting global standards. The vibrancy of our startup ecosystem, which is defining and expanding on India's goals of inclusion and ushering more people into an inclusive economy, can pave the path:

- India's startup ecosystem is expected to grow at an annual rate of 12-15 percent
- Of the 50,000+ startups in India, around 9,300 are technology-led startups
- On its website, Startup India states that the number of women entrepreneurs is 14 percent (1)
- In India, six companies have achieved unicorn status in 2020, taking the total tally of unicorns to 37
- India also has 207 'soonicorns' that are on the verge of achieving hyper scale and breaking out, based on Tracxn estimates
- These are encouraging figures that show that tech startups have funneled a lot of India's economic growth in the last few years.

Technology matters, now more than ever before. Futurist Ray Kurzweil has made it a habit to make remarkable predictions about how technology will shape the future. We will merge with machines by 2045, he says, pointing to a future where our biology will be made up of equal parts technology and physiology. If technology were to be the backbone of our existence as a species, then it becomes all the more relevant that it is developed with equal participation from women too. There is an urgent need for better gender diversity in technology.

Globally, men dominate the STEM workforce and educational map. When I was doing my engineering in the 1980s, there were only seven women doing the course. Times have changed since then. Every year, on an average, 1.5 million students graduate from engineering courses in India. According to the All India Survey of Higher Education (AISHE) Report 2018-19, India has 993 universities, 39,931 colleges and 10,725 standalone institutions. At the undergraduate level, 51 percent of student enrolment are by males and 49 percent by females across India; for PhDs, it is 56.18 percent by males and 43.82 percent by females; and for integrated levels, it is 57.50 percent for males and 42.50 percent for females. While more needs to be done to encourage more women to continue pursuing their education, there has been good progress over the last few decades (2). In 1980, Indian women received less than two percent of all engineering degrees, but their numbers have grown since then. On its website, McKinsey notes that unlike many other countries, India's STEM education map is encouragingly more diverse, with 57 percent of high-performing women having studied in a STEM field in college (3). In 2018, the AISHE report also found that women received over 31 percent of the engineering and technology degrees (4).

In the US, by contrast, the percentage of engineering degrees that women receive has remained relatively static, hovering around 20 percent for years. Despite the increase over the past few decades of women engineers in the STEM workforce, women still account for only 13 percent of employed engineers, according to the US (5). How much of this is because of unconscious bias, cultural stereotyping, and the inherent difficulties in performing the complex balancing act of being women, mothers, daughters and more? These are questions that do not have easy answers.

But there are positive changes. Today, about 30 percent of researchers worldwide are women, and women hold 26 percent of computing-related jobs (6). Positively, women's earnings are outpacing those of men's when it comes to high-skill jobs. There are many examples that show that women empowerment is beneficial to family and society at large. The Lijjat Papad success story is iconic, growing from an INR 89 enterprise in 1959 to an INR 6.5 billion company. Women have shown that they can create dramatic success stories.

I am positive that there will be more opportunities for women in technology, and they will play a critical role in the next decade. NASSCOM's Women and IT Scorecard 2018 report shows that the Indian IT sector is recruiting and retaining more women in leadership roles (7). It expects nearly half the firms to have a workforce that comprises 60 percent women at the senior level.

Technology has always brought out far-reaching innovation, and more women in tech will offer that vital and much-needed balance to a male-dominated industry. Venture capital will encourage such innovation. It typically creates disruption and enables wealth creation. The venture capital ecosystem in India plays a key role by investing in innovative ideas, helping these ideas achieve product-market fit, and in scaling up. The combined valuation of some of the world's biggest venture capital-funded companies may well exceed the GDP of some countries. Young startups that struggle to obtain capital from banks have benefited from venture capital firms that offer them the funding to realise their ideas, transforming society in the process. Yet, women-led startups often receive markedly reduced funding.

The total investment in women-led startups is only about 17 percent of the total investment of US$188 billion worldwide (8). But as more women enter the world of entrepreneurship, that figure will certainly change. Women, as partners in investment firms, will lead to a broader set of innovations getting funding.

We should inspire more women globally to pursue careers in STEM and create the platform and avenues that make it easier for them to achieve that. We need to create clearer pathways for women to enter into STEM careers and stay there. It is, therefore, important to expand the talent pipeline and make gender diversity the core to hiring. We must work diligently to erase any unconscious bias in hiring or promotions. Corporate rewards that highlight progress in objective hiring and policies that are women-friendly need the spotlight and encouragement.

We need to encourage more girls to code and dream of technology from as early as middle school. There is already much

progress on this path with non-profits like Reshma Saujani's Girls Who Code, which encourages women to pursue an education in STEM fields. In India, we have IBM's STEM4Girls that empowers middle school girls with STEM-related workshops and activities. But there's scope for more initiatives.

Apart from education, we need to support efforts that offer products that adapt technology to women's contexts. We need to highlight companies and startups that are using technology to enable women empowerment, education, safety and healthcare. With the Digital India initiative, we are seeing India's Tier 3, 4, and 5 cities and towns embrace rapid digital innovation. With ease of Internet access, more of India's young women will adopt greater interest in STEM subjects.

Our world will be different with more women in STEM. Diversity and inclusion are broad buckets, but we need to keep the discussion going. The more conversations we have over this, the more change will follow. Progress will happen in its wake.

From quantum physicists and digital innovators to technopreneurs and AI experts, we are slowly seeing remarkable women in different areas of technology doing what women have always done—radically changing the way we live.

Once the advantages of diversity become more apparent to everyone, a diverse tech environment will be the new standard. Our long tradition of dynamic leadership and meritocracy will create a path for change in our society. Together we can build a stronger, more sustainable innovation economy in India.

Author bio

Vani Kola is the Managing Director at Kalaari Capital, an early stage venture capital firm based in Bangalore. She is a renowned investor and a visionary known for identifying emerging markets. Her leadership at Kalaari centers around her commitment to the development of entrepreneurs and her conviction that Indian companies are poised to become global players. Vani is a technology focused investor with many of her investments having now become very successful, validating her aptitude for picking the best young minds and mentoring them to build high growth enterprises. Some of Kola's notable venture capital successes include: Dream11, Cure.fit, Snapdeal, Myntra among others. Vani is profiled in numerous books and has been identified as one of Fortune's Most Powerful Women in Business. She is actively involved in various organizations focused on fostering entrepreneurship and women leadership. Outside of work, Vani enjoys spending time with her family, practices yoga and heartfulness meditation devotedly. She believes in sustainable living and grows enough organic produce in her garden to meet her family's needs.

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1
FINANCIAL TECHNOLOGY

India has emerged as one of the world's most compelling FinTech sandboxes. India Stack, developed on the JAM (Jan Dhan + Aadhar + Mobile) trinity, has accelerated financial inclusion in the country over the last decade. Few other major economies are re-engineering and optimizing how over a billion citizens can transact, spend and save digitally the way India is. The JAM architecture has paved the way for unprecedented innovation in the FinTech space. What started as the world's most massive one-sweep identification exercise (Aadhar) and a proliferation of banking services and payment gateways has morphed into innovation that aims at reaching every segment of Indian financial consumer – retail traders, small business operators, startup entrepreneurs, previously excluded groups like rural women, and others.

With multiple vectors converging, here are four inspiring entrepreneurs that are developing and deploying proprietary FinTech platforms in India.

WOMEN ON THE FRONTLINES

1. Open Financial Technologies: Asia's first neo-banking platform for SMBs and startups
    Mabel Chacko - Co-founder and COO, Deena Jacob - Co-founder and CFO

2. Streak AI Technologies: Democratising stock markets with retail intelligence software
    Jayalakshmi Manohar - Co-founder and CPO

3. Simpl: Platform for simplifying payments and credit wallet
    Chaitra Chidanand – Co-founder and President (former), Now new stealth venture

Open Financial Technologies: Asia's first neo-banking platform for SMBs and startups

Mabel Chacko - *Co-founder and COO,* *Deena Jacob* - *Co-founder and CFO*

At Open, you came together to solve a problem both of you had experienced in your previous ventures with the lack of financial infrastructure for small and medium-sized businesses and startups. Tell us how you are building financial tools for your fellow entrepreneurs.

Business banking was broken for small businesses. Large enterprises enjoy special privileges of transaction banking groups, but most small businesses are deprived of these. Small and medium-sized enterprises (SMEs) face a lot of difficulty tracking and forecasting cash-flows, effectively managing account receivables and payables. They need to deal with multiple interfaces for accounting, payment gateways and payroll, and there is a lack of online tools to help them plan their day to day activities. We saw these challenges ourselves in our previous stints of running and managing startups. While I [Mabel] was running a payment gateway, I was struggling to make settlements as I had to do individual fund transfers for each merchant. Since mine was a small startup, my banking partners did not see value in giving me "privileged benefits". Deena was leading finance for a cab-hailing startup TaxiforSure back then, and even with their growth and volumes, managing finance was a sure pain, especially in doing driver payouts. Speaking to other entrepreneurs and small business owners, we realised that this exists across a wide cross-section of businesses and we were guided by the principles of building things people want to change in the way banking happened for small businesses.

Open offers a business account in partnership with banks that helps SMEs automate and run their finances effectively. The platform enables businesses to collect payments, do seamless payouts, auto-reconcile and categorise income and expense, thereby automating book-keeping. It also offers application programming interface (APIs) to integrate banking into business workflows. Currently, Open is serving more than 500,000+ SMEs

and processing US$14 billion in transactions annually. Using Open, SME business owners can save at least two hours of a day, which they are able to put back to growing their business.

What are your views on India's financial ecosystem and capabilities vis-à-vis other major economies, and what exciting developments do you foresee?

It is fair to say that India has an evolved financial ecosystem compared to many of the world economies. Systems such as UPI (Unified Payments Interface) have been defining disruptions in the way a billion plus people transact. In banking and digital adoption, the ease of digital transactions and options available are far better compared to even developed economies. The new wave of open banking and other changes in regulation needed for a more holistic financial ecosystem that focuses on broader customer needs and not only as an enabler of money movement is the key shift underway. The creation of new segments such as neo-banking and open credit, account aggregators and the proliferation of new entrants in digital lending as well as conglomerates foraying into providing a financial ecosystem for the customers are all a leap towards the next level of evolving into a customer-need and experience-focused financial ecosystem. Digital banking focused on connected commerce and new age credit underwriting with 360-degree customer interaction on various platforms and point of commerce would be the key themes to watch out for in the coming years.

How has India's technology ecosystem enabled you to build Open in ways that would not have been possible even a decade ago?

Over the past decade, many things have changed. From the way startups are perceived and the kind of technology available, to the financial infrastructure being built to enable digital payments and

real time transactions. Banks too have increasingly opened up to exposing APIs for fintechs to build services on top of the bank account.

Both of you are serial entrepreneurs. What lessons have you brought along from your previous ventures that have contributed to Open's success?

There is a lot of deep learning in the trenches of the startup world. We will not say we know everything, but we surely know what we should not be doing, because those are learning from our previous experiences.

As four co-founders, how have you structured your founding team to deliver optimum results with transparency and open lines of communication?

All four of us have a clear operational area we manage. Anish is the CEO and he manages business strategy. Deena manages finance, lending and wealth management. Mabel handles marketing and operations and Ajeesh manages the technology. This structure is built on our skill sets and brings in a lot of clarity on what each of us contributes and what we are accountable for. And the core of all this is the trust we have in each other that we are constantly working towards the betterment of Open in all that we do. At the same time, we could not have achieved what we did without our team. We have some guiding principles by which we select our teammates—we look for self-starters, we look for people who do not settle, we look for people who have done something of their own before. We do not punish our teams for making mistakes, instead we use each opportunity to learn and grow collectively. And this in many ways has brought in a culture that's truly Open and defines what we stand for.

Streak AI Technologies: Democratising stock markets with retail intelligence software

Jayalakshmi Manohar - Co-founder and CPO

Streak is revolutionising the daily retail investor's trading experience. Tell us how you developed Streak's unique value proposition.

The stock market has evolved thanks to technology since its inception. From the trading floors at exchanges, to placing orders via telephone, and now trading via terminals made accessible by brokers' software applications on your mobile phones, the markets have been at the forefront of adopting technology quickly. However, although the trading applications available to retail traders have eased order placement, they do not equip the trader with sophisticated tools to make timely trading decisions. We see traders lose out in the markets, with over 90 percent of trades making a loss.

On the other hand, institutional traders have financial resources, large teams and advanced tech infrastructure that help them take calculated positions to minimise risk and maximise profits.

Streak was founded to democratise the retail trading landscape and empower traders by equipping them with sophisticated state of the art technology that can be wielded via a simple easy-to-use interface that requires no coding knowledge. Retail traders can now access Streak's intelligence layer to make quick trading decisions while being able to track their positions in the market with pre-defined entry and exit strategies. On Streak, retail traders have run over 35 million backtests, deployed over 4.3 million strategies and placed orders that have generated a traded value of over US$1 billion.

We wanted to provide traders with an end-to-end platform—from being able to strategise the trading ideas they see on charts, to backtesting their strategies and finally being able to execute these strategies in the markets. With Streak, a trader is no longer blindsided by market moves but is equipped to handle market movements across multiple asset classes like equities, commodities, currencies and future contracts on the go.

The average Indian's participation in equity markets is minuscule compared to other major economies. How can a platform like Streak change this? What are the challenges you will face?

In a country with a population of 1.2 billion and one of the highest household savings ratios in the world (30 percent), India's retail participation in the stock markets is a feeble two percent. The number drops drastically when you look at active day traders or swing traders. To add to the low retail participation, another problem that goes hand in hand is traders drop off.

The predominant reason behind this is a lack of financial literacy that prevails in the country, which has been the biggest challenges that we have faced. With Streak, we want to bring about a radical positive change by addressing this issue within our product offering. Several features of the product, such as backtesting and paper trading, act as training wheels for novice traders or those who have not previously participated in the markets.

The other challenge is trading biases and behavioural biases that people have, which causes huge losses and sometimes leads to wipe-outs. Our platform is also designed in a way to address some of these issues and measures are inherently built into the platform.

We believe that strategic trading is the future of stock markets and retail traders are quickly adopting our technology. Over 380,000 traders have used our platform, with most being millennials. We have seen a phenomenal growth uptick among millennials who are investing their time in educating themselves, with the number of demat accounts opened nearly doubling in the last quarter.

The advent of new age tradable assets such as cryptocurrencies, where markets run 24/7 across the globe, has put Streak at the forefront, making it the go-to platform for traders due to the ease of trading multiple instruments in a simplistic way.

What lessons do you share for fellow entrepreneurs who want to Make in India and deliver quality digital products to domestic and international customers?

Think scale, think global.

We are at the cusp of globalisation and digital connectivity, which has transformed how product building needs to be thought out. We now live in a world where a product built in any corner of the country, even from a small town can be quickly adopted by people around the globe.

It can be overwhelming to build a product that can be accepted by millions of users globally; after all, people's behaviour is influenced by the geographies and culture they are exposed to. However, this can be simplified when you break down the product building process into two parts—functionality and user experience.

With functionality, you have heard it before—solve a real problem and users will flock to your product. To solve a real problem, you first need to put yourself in your consumers' shoes and then tackle it in a way that will produce a simple yet powerful solution. The solution needs to be at least 10x better than the current alternative. This part is often the hardest and most iterative in nature. It will require you to build prototypes, betas and test it in the market and sometimes question your own beliefs.

For digital products, UI/UX plays multiple crucial roles in a user's journey. UI/UX is how a user gets to know your company and it is vital to deliver a seamless, consistent experience across the multiple touch points. This process will require a different kind of research, where you will spend most of your time getting to know

what kind of UI your user is already familiar with and the UI/UX that might work locally may not necessarily work globally.

Finally, the tech stack you use to build your products needs to be well architected. Great ideas and market research most often fail due to poorly architected tech infrastructure. It is imperative to not only design a good stack but to also keep evolving it as your product scales, something that works for the beta stage might not necessarily work for a scale of 100,000 and it might need to be evolved further when you hit one million.

As a serial entrepreneur focused on delivering a stellar product experience to all Streak users, what would you recommend to those who are contemplating or just starting out on an entrepreneurial journey?

First, make sure entrepreneurship is for you. Entrepreneurship is not a career path, it is a mission to solve real world problems to make this world a better place for all of us to live in. It requires dedication, will, determination and zeal to overcome every obstacle that may come your way. Therefore, picking a problem that you are passionate about and creates a huge impact in society is half the battle.

Second, learn from the mistakes of other entrepreneurs. In the last three decades, we have seen technology startups rise, boom and also fail. There are lessons to be learnt in every startup that you see around you, from the ones that have succeeded as well as failed. If you are contemplating a startup of your own, you have abundant resources at your disposal to learn from.

Third, discover your unique strength. The foundation of a great startup is the team you start out with. Ideas are dime a dozen but only companies that can execute them well will see the light of day. It is imperative to discover your unique strength and then find team members with complementary skillsets who are equally passionate about your mission.

Simpl: Platform for simplifying payments and credit wallet

Chaitra Chidanand - *Co-founder and President (former), Now new stealth venture*

What was your thesis for Simpl and how do you place the customer at the centre of your product design and experience?

Simpl is effectively a digital credit card (no plastic, instantaneously issued and extremely user friendly).

Simpl derived its inspiration from the age-old t radition of a *khata* or tab (book of accounts) used by merchants to serve their regular customers. Neighbourhood grocers, milk men, local fruit vendors, the *sutta* (cigarette) guy outside an office, basically any merchant providing high-frequency services to a customer commonly offers this convenience of a tab to their regular customers. Because it simply makes business sense. It cultivates loyalty, enhances revenue per user (RPU) and lifetime value (LTV) of the customer.

With commerce shifting online, the payment systems that were built for offline transactions were repurposed to serve the new online use case. Repurposing legacy was achieved by adding more layers to the old system. This increased cost and complexity, and sacrificed flexibility and ease (from a user experience perspective).

We saw an opportunity to disrupt the legacy payment stack by re-imagining payments for the new stack—internet, cloud, super-computer in every pocket (the smartphone)—using human-centric design and man+machine intelligence systems.

Human-centric design—or placing your customer at the center of your product design and experience—is a continuous process that requires extreme attention to detail, the ability to look around corners, read between the lines and hear what is not said in customer interactions. Tools and frameworks, from surveys to deep design thinking approaches, are all available to make this happen. However, like with any tool, the will and skill of the wielders determines the end results.

I will illustrate with an example of how I went about applying one such framework while conceptualising a particular product last year.

In mid-2019, I was exploring the potential for building a digital payments product for offline merchants—to be used in brick and mortar stores—to replace the book-based *khata* of the merchant. I zeroed in on the local grocer (used for milk, yogurt, top-ups of daily essentials) as the target use case to start with.

The first order of business in human-centric design is to spend an extraordinary amount of time with the problem and understand it inside out. As Albert Einstein said, "If I had an hour to solve a problem, I'd spend 55 minutes thinking about the problem and five minutes thinking about solutions."

Towards this end, I applied the 'observe, interview, immerse and follow the money' framework as my guide to thoroughly understand the problem. By following this approach, I unearthed three crucial nuances that I would otherwise have missed, and the pilot would have failed:

First is the criticality of the cashier in the adoption of a new payment system. As part of my research, I hung around various grocery stores, coffee shops, restaurants and fruit vendors to observe how transactions happened and payments were made. I paid specific attention to the emotions of the various stakeholders. I timed every mode of payment discreetly using a stopwatch and recorded my findings. This made me realise that when a payment method did not work, the cashier got incredibly stressed, especially during rush hour since this causes a line build up and people get restless, and both customers and managers vent their anger on the cashier.

Digital payments took the longest (90-120 seconds) to process. If the internet worked, cards took about 32-35 seconds; and cash payments took 45-50 seconds (from the time the card/cash was handed over to the time it was returned). And so, cashiers urged customers to use cards and cash, especially during rush hour. This made me realise that although the customer is god, the cashier is the priest. If our product was to succeed, we needed to ensure the cashier was naturally inclined to champion it (and have no reason to dissuade its use).

Second is the role of keyboard-shortcuts in the product prototype. Once it was clear that the cashier was a key stakeholder, I decided to dig deeper into their role. I became an undercover cashier for a while to experience first-hand how money flows through the cashier's life. I learnt that a cashier's most stressful time is the rush hour, at which time they rely heavily on muscle memory. Keyboard shortcuts were crucial to any data entry they had to make. Shifting to a mouse added unwelcome delay, broke their flow and increased the chances of making mistakes. Since the product prototype we built required them to make some data entry, unearthing this seemingly minor detail ensured that we did not inadvertently add any complexity to the cashier's life, and instead ensured we built a product that was 10x faster from their perspective.

Third is the invisible accountant. The back-office accountant was a critical stakeholder, otherwise invisible to any observation, unearthed purely by following the money. The crucial thing with respect to this role was not to keep the person happy but to ensure they do not become unhappy. What could make them unhappy? Any inexplicable discrepancy in the tallying of payments system accounts with orders and inventory.

With the experience of building Simpl's online product I was convinced to believe that reconciliation was a critical function managed by computers via back-end APIs and not humans; the merchant dashboard existed as a secondary tool.

By interviewing these stakeholders and focusing on money-flow questions, I realised that in a brick and mortar store, reconciliation was done manually, every day before closing the store. And any inexplicable discrepancy, no matter how small or large, was deducted from the cashier's wages. This meant an easy-to-use merchant dashboard was the number one priority, as opposed to customer facing product elements.

Had I not discovered these little details by meticulously following the 'observe, interview, immerse and follow the money' process, our pilot would have looked very different. Out of sheer habit, we would have focused on the obvious—the end consumer and store owners and built beautiful products for them—missing these crucial *priests* in the middle. And though the gods might have blessed us, the priests would have blocked the blessings, rendering them inconsequential.

Unearthing these nuances and solving for them in the product prototype itself led to alignment of all stakeholders early on. The cashiers prompted customers to use our product, especially during rush hour (a step that was critical in the early days when our product was unknown to the customer). Since the bulk of purchases happen during this time, we were able to capture 20 percent to 25 percent of the store's payment volume in a matter of four weeks since launching at a new store.

How do you envision the FinTech revolution in India and what learnings can we deploy globally?

India is ahead of the entire world when it comes to fintech. This is an unprecedented time, ripe for entrepreneurship. That does not mean it is easy or that success is a given. To succeed is still going to be hard, especially given the noise. But how often do you get events like Unified Payments Interface, demonetisation and COVID-19 happening in quick succession? Technology, a political experiment and a freak global catastrophe happening one after the other, each acting as a forcing function for acceptance, usage and advancement of financial technology.

There are no 'learnings' that can be deployed globally. Banking in each country is a deeply entrenched lobby, a legacy system that cannot be displaced or even edited easily. It requires strong political will, which cannot be transported as a 'learning'. It either happens or it does not; when it does in your country, make the most of it.

What I see in India that is great is that there is an unprecedented openness from both government and regulatory bodies like the Reserve Bank of India to listen and collaborate with the private sector. The last time this happened was in the early 1990s and it led to the IT boom. While the direct effects of the IT boom are obvious, the indirect effects are more noteworthy and offer parallels to envision the fintech boom's impact and effects.

The success of IT, more than any other change, helped legitimise capitalism in a country where policymakers and intelligentsia long harboured a suspicion of markets and the private sector. This unleashed a tremendous energy among people; entrepreneurship, long denied, started to become celebrated.

I believe the fintech sector is going through a similar moment. The energy is palpable. Entrepreneurship in this space is just starting to take off. Open architectures, unbundling of data, an open mind towards first principles-based thinking are all promising vectors. I can say confidently that there's a lot left to come.

It is great to hear that your next venture endeavours to further improve financial inclusion among women in India. What is your vision for this?

My vision is to create a global coalition of women thinking,

speaking, and managing money for themselves. My mission statement is 'organising money in the lives of women, globally'.

When women manage money, they invariably co-opt their households' best interest. Empowering women thus will benefit the entire household and society at large in ways that may not even be apparent to us today. We have the opportunity to create an irreversible generational shift when it comes to women and their relationship with money.

You have worked across company scales, from startups to mid-size to large conglomerates. What lessons do you share for technologists on building multidimensional skillsets for entrepreneurship?

My hard-learned lessons are:

Lesson 1: Whatever the source of wisdom—books, successful entrepreneurs, or conventional wisdom—do not accept it blindly. Continue to seek your own truth, and continue to test it; keep unlearning and relearning newer truths (because contexts evolve; what worked yesterday maybe irrelevant today). This lesson is courtesy Bruce Lee.

Lesson 2: Try not to be stupid, instead of trying to be highly intelligent. To do so, always invert. Turn a situation or problem upside down. Look at it backward. This may not seem cool, but it works. Consistently avoid the stupidities and you will succeed. This lesson is courtesy Charlie Munger.

Lesson 3: Do not straitjacket yourself in your career or life choices. Look at them as a collection of experiences. Whether they delight or disappoint is immaterial; they invariably offer up learnings that you can lap up only if you are not caught up in the emotion of delight or disappointment. The journey is the purpose of life, not the destination. The destination is death; it is useful to remind yourself this from time to time. This lesson is courtesy Chaitra Chidanand.

About the Authors

Mabel Chacko is a fintech innovator and the co-founder of the neo banking platform Open that offers a business banking platform to SMEs and startups. She co-founded her first start-up CashNxt in 2007, Neartivity Wireless in 2009 and Zwitch, which was India's first developer focused payment platform, which was later acquired by Citrus Payments in 2015. Mabel has been the recipient of the 'Startup Leader of the Year' Award from the Ministry of Electronics & Information Technology, Government of India, and has also been recognised as one of the 'Wonder Women in Fintech in India' by Medici.

Deena Jacob is the co-founder, CFO and Head of Revenue and Growth of Open, a fintech startup, which offers a neobanking service for SMEs and startups. Open is Asia's first neo-banking platform that helps SMEs automate their business payments, banking and accounting functions in one unified service to help business owners focus on their core business. Previously, Deena was associated with Tapzo as the CFO, and with TaxiforSure and Zansaar.com as the Head of Finance. She has been a winner of CIMA (Chartered Institute of Management Accountants) Most Influential CFOs Award in 2016 and was also chosen in the top 100 CFO roll of honour by CFO India in the category management controls in 2017.

Jayalakshmi Manohar is an entrepreneur who has co-founded two startups and taken up leadership positions in Engineering, Marketing and Product Development. Her passion for creating and launching new products has now led her to stock markets. At Streak, she has set out to bring financial inclusion to retail traders and investors by giving them state-of-the-art technology, which was so far only accessible by institutional investors, hedge funds and HNIs. Her journey began in 2015, when she co-founded TrialKart - a deep learning AI solutions company that was later acquired by an e-commerce start-up. She then went on to lead Engineering teams and played a crucial role shaping the User Experience and User Interface.

Chaitra Chidanand was the founder of one of the most popular fintech startups in India, Simpl. An engineer by training, she started coding when she was 9 years old. She went on to get an MBA from Stanford. The challenges she experienced dealing with the banking and financial system in the US made her realize that despite paradigm shifts in technology and design thinking, money matters continued to be archaic and intimidating in most people's lives. Making money simple became a life mission for her. Simpl was the first step; through which she believes she only scratched the surface. With her next venture she intends to move the needle much farther. Her next venture is focused on women and giving them control over how money flows through their lives. Previously, in her career she has built an AI inspection system that was deployed on Apple's manufacturing lines, moved Sony Pictures Television to repurpose their library of content for digital distribution (led to creation of Crackle), helped a Mexican cinema giant launch in India.

2

DATA PLATFORMS
AT THE EDGE

Data is the new oil, and platforms are the new engines in the 21st-century digital economy. The ability to build integrated platforms and innovatively utilize data sets unlocks multiple new business models. With frontier technologies like artificial intelligence, machine learning, big data analytics, and others becoming increasingly mainstream, entrepreneurs around the world, including India, are capitalizing on the force-multiplier effects and building large data platforms to either address niche gaps with a first-mover advantage or develop multi-market strategies in the B2B, B2C and B2B2C spaces.

Here are three energizing entrepreneurs who recognize the exponential advantage of technology, data and AI, and are deploying deep multi-market technological plays starting with the e-commerce, venture investment, and retail spaces.

WOMEN ON THE FRONTLINES

1. Infibeam Avenues: One-stop for payments, digital infrastructure and platforms
   Neeru Sharma - Co-founder and Director-CorpDev

2. Tracxn: Data intelligence platform for investments and corporate development
   Neha Singh - Co-founder and CEO

3. Mad Street Den: Building generalisable Artificial Intelligence architectures at scale
   Ashwini Asokan – Co-founder and CEO

Infibeam Avenues: One-stop for payments, digital infrastructure and platforms

Neeru Sharma - Co-founder and Director-CorpDev

Technology carries an exponential advantage of low marginal costs and near-infinite scalability. Tell us how Infibeam has used this advantage to expand into a conglomerate today.

Infibeam Avenues offers digital payments and software platforms to enable businesses and governments to transact online in India and abroad. Our asset light business model, highly scalable infrastructure capabilities and transaction-based profitable revenue model has enabled us to significantly enhance business and shareholder value. This is the rare combination where a company offers both a digital payments and software platform.

Infibeam's rise coincides with the acceleration of India's technology ecosystem in the last decade. How did you capitalise on this acceleration and what exciting developments do you foresee (both for India and Infibeam)?

Over the last decade, India has witnessed a wide transformation in the way digital technologies are used to disrupt business operations and influence consumer behaviour. Both B2C and B2B customers across private and public sectors were introduced to the digital way of transacting and, owing to the pace, scale and innovation in the sector, this shift has been widely accepted. It has become the need today. Infibeam has made its mark in the technology space by catering to this need with solutions in specific areas like e-commerce platforms, payment technologies and infrastructure. Today we offer an all-in-one integrated portfolio for customer needs globally.

Infibeam is involved with the government e-marketplace. How do you view new opportunities in tech-enabled governance initiatives?

As part of the digital India movement, we see several initiatives in e-governance that are bound to transform India into a digitally empowered society. There will be opportunities in every sector as digital infrastructure is enabled for every citizen for every need. The empowerment of citizens in the digital space will ease usage, and ensure pace, transparency and increased trust for all their government dealings. Financial transactions becoming cashless and digital will lead to increased opportunities and innovation in the fintech space.

You have donned many hats in your career, both at Infibeam and earlier. What prompted you to do this, and what lessons can you share for people to leverage their technical backgrounds to build their own tech ventures?

I think we are all citizens of a global digital economy today. We need to be aware of what is happening around and what it can lead to. This realisation and exposure led me on my entrepreneurship journey. Technology is a platform-agnostic enabler and a basic need today. The scale in terms of geography or size is unbounded and techpreneurs should realise this. Business insights and market research should carry a global dimension. Also, a tech business idea cannot be a snapshot in time, instead it should be an initiation of a journey of tech innovations over changing business needs for the problem the techpreneur intends to solve.

Tracxn: Data intelligence platform for investments and corporate development

Neha Singh - *Co-founder and CEO*

What is the gap you studied in the venture and technology investing space that Tracxn is solving with a data analytics approach?

When you are looking to invest in public markets, there are a variety of platforms providing the required information. But as private market investors—in venture and private equity firms—there were hardly any platforms providing the required information about seven years ago. In the last decade, the private markets have become sizable, both in terms of investment activity and the number of inevitable companies. But still the information required for sourcing must be manually curated by the investment professional, for instance, finding all EV startups in a particular region.

This is the information gap we want to bridge. Today, Tracxn is building the world's largest platform to globally track private companies in the emerging technology sectors. We track over one million companies operating in over 300 technology sectors across more than 30 geographies. We have designed algorithms to analyse market signals that can identify innovative companies and make precise recommendations to our team of analysts for the next level of curation. This combination of artificial intelligence (AI) plus human-in-the-loop has helped us maintain a high degree of accuracy while exponentially expanding our global coverage.

Tracxn has built a vast database of companies and technology sectors. What are some of the fascinating trends and leading sectors you have unearthed within the Indian technology ecosystem over the past decade?

The past decade has seen tremendous growth and progress in the Indian technology ecosystem. India is ranked third globally in terms of venture capital funding, behind only the US and China.

With the total year-on-year funding amount increasing ten-fold and 19 unicorn companies created during this period, the Indian startup ecosystem is maturing at a staggering pace.

Three market segments have seen especially strong growth and are expected to continue their upward trend in the coming years—consumer businesses, global SaaS and fintech. Consumer businesses such as e-commerce, e-commerce enablers, hyperlocal delivery models and transportation are among these leading segments. The consumer industry boasts of nine unicorns from multiple verticals and includes many success stories, such as Flipkart, Ola, Oyo, BigBasket, Swiggy, Delhivery, Rivigo and Practo.

SaaS products catering to global clients is another segment that has seen notable growth in companies. As it has become more democratic to launch software platforms (thanks to infrastructure companies like AWS), we now see many great products coming out of India catering to a global client base. These are horizontal (for instance, CRM, customer support, HR tech) and industry focused (for instance, healthcare, legal services). Companies like Freshworks, Zoho and Druva are a few of the players in this segment that have gained global recognition.

FinTech is the third promising segment that has risen above the rest of the pack in the last decade. From lending marketplaces and payments to insurance and personal investments, a huge number of startups have made significant disruptions in the market and are expected to continue doing so in the future. PayTM, PolicyBazaar, Pine Labs, Kredx, Lendingkart, Rupeek, Zerodha and Scripbox are some of the companies that have become market leaders in the fintech space in the last few years.

How do you envision using Tracxn's valuable data trove to drive the next era of private market investing?

Investors spend a disproportionate amount of time in scouting for interesting companies, while founders spend a disproportionate amount of time and effort in finding the right investors. We aim to bridge this gap. For instance, if an investor wants to invest in agritech, we want to make it easier for them to discover all agritech startups across India. Using technology and sector-focused analyst teams, we organise the data around private companies—about companies, their teams, stage, sector, and business models—making it actionable for investors and corporates. At the same time, we help corporations track upcoming innovation in their industries.

How do you approach global sales and provide a stellar product experience with such a varied roster of clients and in so many target segments and geographies?

We have customers in 40 different countries, which include over 70 Fortune 500 organisations. This is backed by our coverage of global emerging technology sectors and companies. For global sales, we have an inside sales team that works in various time zones across the Americas, Europe, the Middle East and Africa and Asia-Pacific. We have seen that customers, including large

organisations, have become more open about buying software through remote meetings. Hence, we can build our sales team centrally in Bengaluru without needing to build a local sales team in every geography we serve.

At the same time, India has seen a tremendous improvement in the quality and quantity of its technology talent pool. The establishment of product development offices by large global technology corporations such as Google, Microsoft and Amazon in India has resulted in a sharp rise in the availability of high-quality engineers who are able to build and deliver world-class products. This has helped Tracxn build a strong team of highly skilled developers who can build a world-class product platform.

Our central philosophy is based on the idea of creating an AI-powered human-in-the-loop system. This enables us to provide customisation and personalisation to each individual client at an unprecedented level. Our extensive global database of companies coupled with tailor-made products and features allows clients to source and track companies across sectors and geographies to precisely match their mandate requirements.

Mad Street Den: Building generalisable Artificial Intelligence architectures at scale

Ashwini Asokan - Co-founder and CEO

What is your contrarian thinking about enabling people to participate in the Artificial Intelligence (AI) economy? Please share your thoughts on why the average Indian must be excited about AI.

The central thesis for our company and our journey as entrepreneurs has always been 'helping people become AI-natives'. There is a distinct milestone coming up, one where all the infrastructure, hardware, cloud, software, and our knowledge of smart systems are exactly where we need them to be for the perfect storm. And the market is ready. This pandemic has wreaked havoc, but it has also served its purpose of pushing industries to think about change as a necessity and not as an option. And there is a race for access to trained talent, experience and infrastructure. China obviously leads this right now, with the US at its heels. India really needs to sit up and ask where it is in this game. We have a choice ahead of us—either become like the talent powering companies in China and the US, replicating the decades that have gone by, or become the powers that have put AI to use in a meaningful way to help its citizens get better access to finance, healthcare, lifestyle and more. Racing to become a surveillance nation is not what we should be focusing on. There's immense talent in the country that is ready to build new companies, new infrastructure for the country and more. Finding ways to remove friction in those processes and create systems that do not hinder growth is extremely important.

In a nutshell, our motivation and ambitions are to build an AI-literate, AI-native talent and force of people across a variety of disciplines who are vested in the creation and design of AI, not just the implementation of readymade solutions.

How did you personally arrive at your unique thesis about AI?

From the latter half of the 2000s until a few years ago, AI was still largely all about early experiments. We have been trying to breakthrough on hardware, software, architectures, silicon, neuroscience, user interface, understanding of human behaviours and more. And in the last ten years, the mobile has evolved faster than the 50 years before that. Mobile, data and the internet accelerated everything.

I was part of an interdisciplinary team of experts across these disciplines while working at Intel in the Valley for Genevieve Bell, a wonderful anthropologist and leader who was challenging the way corporations were thinking about the technological change ahead of us by putting people at the centre. For decades, she and other Intel fellows like Lama Nachman were laying the ground for where we are today. They were asking the ecosystem to think about how humans would interact with sensors, with technology that had some 'smartness'. At the same time, I was privy to my husband and now cofounder Dr. Anand Chandrasekaran's work in neuroscience and neuromorphic engineering in academia. I was observing growth in academia and in industry while developing my own point of view on the future of technology and building some versions of it at Intel.

It became clear to me that both academia and corporations were approaching AI as a bunch of specs, as pushing hard on physics and performance and more. This is undoubtedly critical and fundamental to this trajectory, but it was always at the cost of pushing the envelope on the why and the how. We were hardly thinking about who would use this, why and how, or the place of AI in a world full of humans. Beyond the movies and the shows we now have, I doubt we have made a lot of progress as humanity on consciously designing a path for AI and a path for humans to be in a world with AI.

This pretty much became the bedrock of my thesis around why I wanted to build this company to focus on three things:

■ Building new AI architecture that allowed us to deploy AI on scale across a range of applications motivated by people's real needs
■ Develop and design AI-powered solutions that made people's work and lives better in ways they could not foresee
■ And enable us to recruit people into the world of building and designing AI

This is our path at Mad Street Den.

Mad Street Den spun off its first vertical with a retail focus. How do you envision an AI-backed solution will change the face of the retail industry?

Retail is among the most 'legacy' industries there is today. Coupled with the fact that the consumer buying today is nothing like the industry out there makes this the perfect space for disruptors. The retail industry is being disrupted piece by piece, department by department, faster than we have ever seen before because of the pandemic. We are seeing AI at the centre of this change. Whether it is processing contactless payments, enabling retailers to do contactless photography, or helping merchandisers and teams automate their processes so they can focus on performance and value generation rather than doing manual tasks, the opportunity for AI is huge. And we are seeing chief experience officers all over the globe run to embrace this change and enable their employees to adopt it as well.

Which sectors are you focusing on next with the Mad Street Den platform solution, and how do you approach global markets with it?

We have been global from the get-go. Opportunities for growth in retail the world over is incredible. At Mad Street Den, our ambitions stretch far beyond retail. Vue.ai, our retail vertical is the start. We have learnt discipline, rigour, mechanics of the business, the domain and organisation building. In the coming years, we will certainly be looking to expand. The market is ripe for disruption. There are problems in finance, insurance, healthcare, shipping and so much more. There is also the problem of making developers participate in the creation of these solutions. We see this as a demand and supply problem at Mad Street Den. It is not enough to just focus on industries that need help, it is equally important to focus on the talent and the community that will be building this. This is our goal. We look at AI as a problem of demand and supply and not just as a tool to solve problems. We are invested in creating this community and growing it across the country. We have done it with Vue.ai and we are all set to grow and replicate that.

About the Authors

Neeru Sharma is the Director, Platform Business at Infibeam Avenues. She has over a decade of ecommerce experience where she has worked with conglomerates like Amazon before starting with Infibeam Avenues. She has played a pivotal role in scaling Infibeam to multiple business models, geographies and customer segments.

Neha Singh is an ex-VC from Sequoia Capital and a former BCG Consultant. She did her MBA from Stanford and holds B.Tech and M.Tech degrees in Computer Science engineering from IIT Bombay. She was recognized by Business Today as one of the Most Powerful Women in Business in 2019 and was featured in Fortune 40 under 40 in 2018 and 2019.

Ashwini Asokan is the CEO & Co-Founder of Mad Street Den, a Computer Vision and Artificial Intelligence company. Ashwini returned to India from Silicon Valley after more than a decade to bootstrap her startup, which she founded with her husband, Anand Chandrasekaran, a neuroscientist. Ashwini has been exploring how Artificial Intelligence can be brought out of the Science and Tech labs of the world, applied meaningfully and made accessible to people across the globe. Prior to starting her own company, she led Mobile Innovation efforts as part of Intel Labs in California, driving research and development of AI and mobile products.
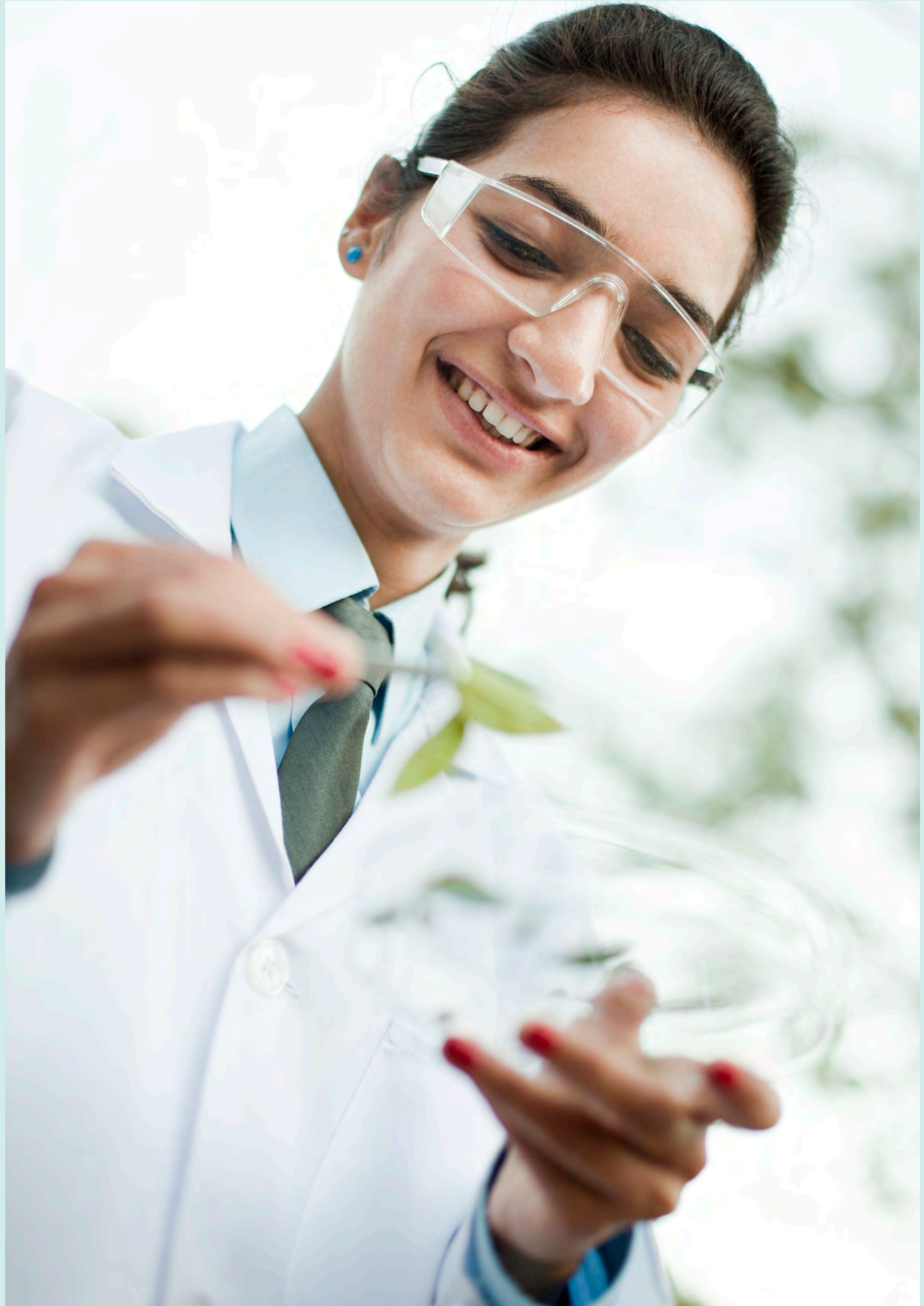
3

SCIENCE AT THE FRONTIER

A vital pillar for a flourishing society is scientific innovation to advance sustainability, energy, agriculture, health, and many other fundamental aspects of citizens' lives. Scientific innovation often constitutes extensive early-stage high-risk research and development with long gestational and validation timelines. India, particularly over the last decade, has seen the rise of a small but determined community of deep science researcher-turned-entrepreneurs working in these fundamental areas and developing inspiring breakthroughs to change the way India and the world can deal with significant issues like sustainability. These breakthroughs hinge on extensive research, intellectual property generation, product validation, and compelling go-to-market strategies.

Here are four deep science innovators who started with scientific first principles, developed and validated their products, and are implementing farsighted visions to make the world a more sustainable and energy-efficient planet.

WOMEN ON THE FRONTLINES

1. Sea6 Energy: World's first ocean operating system for bio-sustainable products
   Sri Sailaja Nori - Co-founder and Dir-R&D, and **Sowmya Balendiran** *- Co-founder and Dir-BD*

2. String Bio: Integrated methane platform for next-gen sustainable ingredients
   Ezhil Subbian – Co-founder and CEO

3. Fibsol Life Technologies: Redefining agri input efficiency via nanotechnology
   Kavita Sairam – Co-founder and CEO

Sea6 Energy: World's first ocean operating platform for bio-sustainable products

Sri Sailaja Nori - Co-founder and Dir-R&D
Sowmya Balendiran - Co-founder and Dir-BD

At a time when the whole world was focused on biofuels, how did you differentiate Sea6's value proposition and grow your product catalogue?

Initially, we started as a group of students and professors at IIT Madras focusing on producing biofuel from microalgae. But we quickly realised that though the solutions were technically possible, the real issues were the economic feasibility and scalability of raw material (biomass). India has always had a scarcity of fertile land and water. Most of the biofuel technologies visualised large areas of land to be farmed for producing biofuel. This also involved an enormous amount of water. But considering our growing population and limited resources, we understood there was a need for a radical solution.

We turned to the oceans as a potential source of scalable biomass. This circumvented the issues of the 'food vs fuel debate' and gave rise to the possibility of automated large-scale farming. Sea6 Energy became a pioneer in ocean farming technologies and using a versatile product range from sea plants. Over the years, we have developed farming technology to make it robust, scalable and sustainable. We have also developed novel products for agriculture to enhance growth and control viral attacks that cause huge losses to farmers. We are currently in the process of developing food ingredients, feed solutions, bioplastics and biofuels based on ocean biomass. Sea6 Energy has a portfolio of four granted patents and three additional patents filed for the future product portfolio.

Tell us about your unique ocean operating platform and journey building a proprietary biomass harvester that can operate in the middle of any ocean in the world.

The SeaCombine has been designed to efficiently seed and harvest tropical red seaweeds while on the sea. Traditional systems require a lot of the farming activities to be done on land, which increases the transport time and cost involved in the process. Not only this, the seaweed unnecessarily spends a lot of time outside the water during the process, which leads to loss of quality. Using our proprietary equipment, we can do a lot of the farming while on the sea, increasing labour productivity and allowing farmers to farm much larger areas of the sea.

The journey has not been an easy one as we were looking to build a solution that was robust enough to use on the sea and yet versatile enough to handle the variation between different sea plants. We had tried several different approaches, and it was especially difficult considering that the seaweed would behave just a little differently at various sites and seasons, which led us to make several versions of our designs. However, the final design is quite robust and can work across sites and seasons with ease. This system will enable farmers to effectively farm several hectares in the sea compared to earlier systems, which allowed less than few square meters per day. This provides a solution for scalable high-quality biomass production.

In an area where India traditionally imports patented products, how did you turn the proposition around to market your patented products internationally?

Traditional Indian agrichemical companies have always imported innovations from the West and introduced it to local farmers to enhance farm production. However, there has been limited innovation by Indian companies to produce new molecules and products that could benefit the local farmer. Also, the impetus to research on high quality organic/biological formulations has been scarce.

When Sea6 started focusing on interventions that can impact farmers, we realised that there is a need for scientifically proven

organic productivity-enhancing products. So, we continued our research in this field for five years and then launched our patented product Agrogain, which enhances plant growth. We are the only company in the world today to have a patented a seaweed-based biostimulant.

We were also awarded a special mention in the Best Biological products category at the Agrow Awards, marking the first time an Indian company had won in this award. We continued conducting multiple trials across the world with leading research institutes and contract research organisations to validate the product. We also built strong scientific evidence to support the use and efficacy of our products.

With all these attributes, we approached global market leaders like FMC Corporation and Summit Agro (Sumitomo Group) and partnered with them to sell our products globally. We already export to many countries, including the US.

India has built extensive infrastructure around agricultural research. How were you able to leverage this and what are your thoughts on the new structures the government must invest in for the country to become an intellectual leader and solutions provider in the field?

India has an extensive network of research institutions dedicated to agricultural and animal sciences research under the Indian Council of Agricultural Research (ICAR).

When Sea6 Energy started exploring applications of sea plant extracts in agriculture in 2014, we were able to leverage this network and sponsor research projects with ICAR institutions specialised in crop-specific research to evaluate the efficacy of biostimulant and plant health products. The access to animal science research institutes also enabled Sea6 Energy to develop applications of sea plant extracts to improve health and alleviate stress in shrimp, poultry and livestock. For those of us at Sea6 with minimal or no experience in agriculture and animal sciences, the

interactions with scientists from these institutes have been an amazing learning experience.

The government should create clusters/centres where industry and academia could focus on solving relevant problems using an interdisciplinary approach. The implementation of modern technological practices at the farm level has to be pushed through policy. Access to funding for initial idea is available from the government, however, growth focused funds are not available for startups to commercialise their technology. Grow-out spaces for startups are also not available.

Having perfected the processes for producing biomass at scale, what is next for Sea6? How will you leverage this core proposition to expand into the multiple markets that utilise massive quantities of raw biomaterials?

Sea plants have yield potentials exceeding 100 dry tonnes/hectare per annum and they represent a scalable and versatile raw material for multiple industrial applications. Our vision is to harness this potential of sea plants to create a sustainable bioeconomy.

While we have commercialised the applications from sea plants (biostimulant and plant health products) with raw material available from traditional cultivation methods, we have also demonstrated processes that can convert sea plants to food, feed, plastics and fuels.

Biodegradable plastics and biofuels are large volume applications and manufacturing them requires millions of tonnes of raw material and this would be enabled by our proprietary SeaCombine technology.

Over the next three to five years, Sea6 Energy will expand its ocean farming operations and demonstrate biodegradable plastics production at pre-commercial scale. We will also launch products focused on sustainable food ingredients and animal health.

String Bio: Integrated methane platform for next-gen sustainable ingredients

Ezhil Subbian - *Co-founder and CEO*

What is String Bio's comprehensive vision for a sustainable future?

The last few decades have seen a rising toll placed on our ecosystems as we race to meet the demands for food, feed and consumer products of a growing population. The result of this is a huge negative impact on life and the environment around us. Solutions that can address this growing demand sustainably are urgently needed. String's technology enables next generation raw materials that can deliver such solutions. String has built intellectual property (IP) protected technologies (String Integrated Methane Platform) that allows us to produce essential raw materials for everyday living from methane. Our products focus areas are alternative proteins for the feed and food market (fermented microbial proteins that are clean, safe, traceable, high-quality and scalable), and agricultural productivity (methane derived, chemical-free, natural biostimulants that can restore soil health and enhance crop yield).

String's vision is a world where raw materials are locally manufactured in a sustainable manner, where cleaner and better ways of living are enabled by leveraging biological advances efficiently. The last few decades have seen massive advancement in our understanding of biology. We believe that biology presents simple solutions to complex problems that can be leveraged to return balance to ecosystems.

Our mission is simple: to leverage the power of biology to enable sustainable and scalable solutions in sectors that are fundamental to living. Our impacts are in enabling localised manufacturing that provide economically competitive alternatives; leveraging the carbon in greenhouse gases to build strong value chains; enabling safe, organic and natural alternatives; enabling inherent circularity in living; and enabling the transition to value chains that are economically, socially and environmentally sustainable.

How do you envision expanding into global markets while keeping your research and development pipeline rooted in India?

String's vision is to enable supply chain efficiencies through localised manufacturing and consumption. Hence while the core research and development work is in India, our end markets have always been global. This has been our driver right from initiation.

To enable localised manufacturing and consumption in different markets, we are building relationships with strategic partners both on the supply and the market side in different geographies based on market demand for products. Our long-term vision is to enable clusters of gas-manufacturing-product supply chains relevant for that market.

We envision the research and development set up in India continuing to support the clusters with advances in technology, efficiency and products. This year (2020) has highlighted how businesses can be run globally even if face-to-face interactions and travel are significantly restricted. This means that delivering solutions for global markets from India should be easier now than ever before.

How have India's early-stage innovation support systems enabled you to develop the String Bio platform solution? And what policies could India strengthen to promote a stronger innovation-driven environment?

The early-stage innovation support system, primarily funding and infrastructure for biotech startups have seen a dramatic change in the last five years in India.

When String started operations in Bengaluru in 2014, there were only two incubators supporting biotech startups in the city, and

their focus was not exclusively on incubation. Incubation was one of the focus areas in addition to their core presence in education and research. String was lucky to find a place in one to start operations.

However, it is a completely different scenario in 2020. There are at least ten different incubation facilities for biotech companies in Bengaluru, if not more. The primary focus for them is providing high-end infrastructure required for early stage biotech work. And some of the bigger facilities, such as Bangalore Bioinnovation Center and C-CAMP, are expanding their infrastructure to accommodate more incubatees.

One of the key drivers for this massive change is funding initiatives from the central and state governments. The central government's Department of Biotechnology's BIRAC and their numerous funding schemes to make high risk capital available for biotech ventures has catalysed the change in the ecosystem. The Karnataka government has mirrored the effort with state level funding schemes, which is another key driver enabling early stage innovation.

String has benefited a lot from starting operations at the 'right' time in Bengaluru. We have been fortunate to ride the wave as the innovation ecosystem has evolved. We have leveraged grant funding from BIRAC as well as from Karnataka state government for our initial work. We have also extensively leveraged the incubation facilities before moving into our own premises.

Our hope now is that the government does not slow down its effort to enable innovation in India. As the ecosystem evolves and companies mature, there are dire requirements for the next phase of innovation driven growth. Some of the requirements/policies that can be truly enabling are pilot scale manufacturing/testing facilities; plug and play commercial manufacturing parks; regulatory clarity required to bring new home-grown products to market; ease of bringing FDI to support next phase of growth; and strong legal environment to support IP protected innovation.

Given your extensive and global technology development experience, what lessons you can share for making research and development more exciting?

One day I hope to write a book about my experiences with interviewing and hiring for roles at String. While it feels like I have seen the entire gamut of folks walk through the interview room, unfortunately, the majority do not know why they want to make a living working in biotechnology. This is not an issue for some type of roles. But when the requirement is technology and innovation, this can be a major challenge.

The attitude, aptitude, and diversity of thought on the teams driving the effort is one of the key factors to make research and development more exciting and products market relevant. String's operating culture has been to provide folks the freedom to execute on the work that they are responsible for. This was a necessity when we were a small team. We have kept the same spirit as we grow in numbers. Finding the folks who have the attitude to make the right judgement calls and who can drive their responsibilities with passion and efficiency was not easy. However, this has made a clear difference to our growth.

Changes in the education system that encourages students at all levels to learn, explore and dabble can make a huge impact in making this easier. Another aspect that requires attention is the difficulty in having diversity on teams that are technology driven in the current environment in India. Women find in difficult to stay in the workforce once family responsibilities increase. Enablers such as quality daycare centers, daycare centers within technology/incubation parks, pre-approved emergency caregivers made available through work and encouraging paternity leave have made a huge difference to support women in other ecosystems that I have worked in. This is a clear gap even in metros like Bengaluru. As the startup ecosystems evolve, perhaps companies can come together to build this support network.

Another opportunity for exciting research and development is to enable better collaborations/partnerships between academia and industry in the biotech sector. There is a vast gap right now. Bridging this can make a difference to both sides—academic research can be a treasure trove for industry and being tuned into real world needs can attract huge funds for academic research.

FIB-SOL Life Technologies: Redefining agri input efficiency via nanotechnology

Kavitha Sairam - *Co-founder and CEO*

FIB-SOL is revolutionising the fertilizer industry. How did you arrive at this much-needed solution?

FIB-SOL is currently developing and commercialising nanofibre-based agricultural inputs. The product is a five-gram fibre that is soluble in water and can be applied on the field using conventional or modern irrigation practices. The product addresses the demand for live bacteria that could rejuvenate the soil. It could also increase the nutrient utilisation efficiency, allowing plants to assimilate nutrients in a better way.

The idea of entrapping agriculturally important microbes came to me a few years ago, when I had just completed my doctorate. I was working on stress signal transduction to improve secondary metabolite production in fungal systems. At that time, I was keen to start my own business pertaining to science and was exploring many ideas, including the development of assays for biomarkers. That is when my PhD guide and mentor Prof. T.S. Chandra insisted that we should develop some technologies to address issues in agriculture.

This is when I started exploring agricultural practices. I found that the soil has lost its nutrient utilisation efficiency, most of which could be attributed to the soil deprivation of microbes. Indiscriminate use of chemicals has reduced the microbial content in the soil. These microbes are essential for the appropriate absorption of plant nutrients. The soil microbes also play an important role in converting organic manure to nitrogen, phosphorus and potassium (or NPK), which the plants need for growth. Hence, I identified that the missing link in both chemical and organic farming is the soil microbe or biofertilizers

Biofertilizers have been supplied by agricultural universities like Gandhi Krishi Vigyana Kendra (GKVK) for long. However, they are supplied by mixing with inorganic carriers like lignite,

peat and talc, which does not support their existence. I realised that a method to stabilise these bacteria will be a solution. There were technologies like freeze drying, but it is very expensive. Hence, I thought of exploring stress biology, where some stress stabilisers could be added in the bacterial media to stabilise them. Alternatively, electrospinning and encapsulation could be a solution. My junior and co-founder Dr. Anant Raheja was working on nanofibre technology, and we partnered to explore this further. We understood that besides stabilisation we could also increase the payload of cells/unit area using this technology. This would bring down the bulkiness of the material by reducing the carrier thousand-fold. The advantage offered would be huge savings on logistics for distributors and users. Since the stability of the organism was improved, the efficiency in the field also improved substantially. The other advantage of the technology is that a wide variety of molecules, both organic and inorganic, can be entrapped. Thus, the technology is a versatile platform available for the exploitation of variety of agri inputs. Although some research and development effort will be needed as and when new product pipelines are added, we believe that some day most of agri inputs will be redefined using this technology.

Tell us how you set up India's largest in-house production of nanofibres, and how you envision expanding this market further.

Agricultural inputs as a sector has been long ignored and not much research and development has been added, due to low returns on interests associated with it. But improving agri inputs to make them safer and more efficient is necessary. The demand for food will increase with population growth. The soil cannot be eroded constantly of its natural biota. Considering these problems, an alternate solution to redefine agricultural inputs is important.

It is in this context that FIB-SOL is trying to offer the most sophisticated technology of stabilising bacteria through a controlled process of electrospinning in nanofibres. Although electrospinning and nanofibre technology existed for the past four decades, it has not been explored on biologicals. In a market like agriculture, where the volumes are huge, there is a need for a technology that can be scaled up. Currently, electrospinning is largely used for making filtration membranes. At FIB-SOL, we have pivoted it to produce biologicals, with some customisation to the existing methodology. Fib-SOL partnered with engineering companies and had also hired an engineering team internally to focus on the machinery development. The basic parameters needed to produce biological entrapped nanofibres were extrapolated to the large-scale machinery.

Various conditions were optimised and the components needed for the process were built internally and assembled in such a way that we now have the largest scale for water soluble nanofibres in the country.

Apart from indigenous machinery, we have also identified methods to customise industrial scale machinery for the optimal production of our products, removing any production bottlenecks.

Not only are you deploying a new product, but you are also expanding a whole new agricultural input market segment. What are the changes required at a global scale to accept this paradigm shift?

Agricultural inputs are broadly classified as solids and liquid inputs. Today micro encapsulation technology is widely used to entrap effective microbe consortium to improve soil quality and plant yield. FIB-SOL's technology is close to this. Nanoparticles are also widely explored, and several products are developed as nanoparticulate formulations. This is a nascent market and the safety of these products must be tested under specific guidelines. Hence, it is the responsibility of all stakeholders—the government, agricultural institutes, researchers, agricultural startups—in formulating and setting up the new guidelines for nano based formulations. In this context, we are proud to say that FIB-SOL has contributed significantly by registering its inputs for setting up these guidelines. Anant has been actively taking part in the panel discussions on formulating these guidelines and ensuring that our concerns are addressed.

A similar shift is expected to happen globally, since the farming community is aware of the benefits of the new technologies that are currently being developed. Facilitating the usage of such technologies at the ground level will not only increase the benefits to the farmer but will also be a benefit to the environment and society. This is why it is important for all stakeholders to participate in these activities and also educate farmers as well.

What are your views on India's strengths in medical and agricultural research, and support systems for early-stage innovation, and what exciting developments should the country pursue?

I believe the country's potential to innovate in the medical and agricultural fields is huge given the knowledge base. The environment has never been more conducive, with there being many opportunities for the industry and institutes to partner and innovate. Government schemes like BIRAC have been incredibly supportive for researchers to validate and develop their ideas into a commercially viable product. The technology business incubators that are set up across the country ensure that the innovations are provided with all facilities, including research and development, financial and regulatory guidelines. The innovations are nurtured by scientific institutes and startups due to their combined efforts.

In this context, it appears that the future for research in the agricultural and healthcare sectors is currently at its peak and will become more aggressive in the next decade. The support system for early stage innovations is well set and the country will reap its benefits in the coming years.

At the same time, the handholding on the regulatory issues is still a challenge. New products in the agricultural and healthcare system always face regulatory hurdles. Although we need stringent regulations in these sectors, given their importance in human life, it is the responsibility of the government to come up with clear guidelines for these regulations. This will ensure appropriate safety practices as well as an early launch of new technologies for the benefit of the society.

With this platform set, I believe that in the next decade we will see India innovating in various ways in the healthcare and agricultural sectors, and commercialising these successfully.

About the Authors

Sri Sailaja Nori is a co-founder and Director of Research and Development division of Sea6 Energy Pvt Ltd. She leads the research team which is developing novel processes to convert macroalgae into agricultural biostimulants, food ingredients, animal feed, biofuel and other renewable chemicals. She also oversees the corporate governance and finance at Sea6 Energy. Sailaja graduated from the Indian Institute of Technology Madras, Chennai, India with Dual Degree (B.Tech & M.Tech) in Biotechnology in 2010. Sailaja has been featured as special mention in "Science and Green Tech category" in Forbes India "30 under 30" list, 2018. She is a co-inventor in 5 patents (2 granted) and co-author in 5 publications on seaplant derived products.

Sowmya Balendiran is a co-founder and the Director of Business Development at Sea6 Energy. Based out of Bangalore, India, Sea6 Energy focuses on developing technologies using Tropical Red Seaplants in the fields of Agriculture, Food ingredients and Renewable chemicals. Sowmya currently heads the Business operations for their products globally. She has graduated with a Major in Biotechnology, and later went on to pursue an Executive Management program from the Indian Institute of Management, Calcutta. She has over 10 years of experience in International Sales & Marketing across various domains and has been accredited with several awards. She has been featured in the "Top 50 women in Biotech" in India and has also received a special mention in Forbes "30 under 30"- India edition.

Ezhil Subbian, PhD co-founded String Bio and currently serves as the CEO. Ezhil's passion is to deliver sustainable and cost-effective solutions for real world problems. She has 15+ years of experience in development and scale up of various bio-based products. Ezhil was part of early technology development at three different companies in the biobased sector. All three companies have had successful IPOs. Ezhil brings to String first-hand knowledge of solutions that work and bottlenecks that plague biobased product development. Her work was most recently recognized with the Women Transforming India Award 2018 from United Nations/NITI Aayog. Ezhil has a B.Tech in Industrial Biotechnology from Anna University, India and a PhD in Molecular Biology & Biochemistry from Oregon Health and Sciences University, Oregon.

Kavitha Sairam, PhD has expertise in the field of Microbial Stress Biology and received her PhD from IIT Madras in 2012. In addition to microbial biochemistry, she has immense experience in clinical biochemistry through her formal training at JIPMER during BSc and MSc programs. She is an experienced researcher with multiple scientific projects to her credit in addition to several publications and patents. Kavitha has co-founded FIB-SOL Life Technologies Private limited, which is a start-up based on nanotechnology as a platform technology. She is a first-generation entrepreneur. As a founder, she has led FIB-SOL to receive numerous accolades through her excellent project management skills. Playing the role of CEO, she has created sufficient business tractions and has played a crucial role in raising Government and Angel funds, for developing the product and scaling the process.

4

MEDIA AND CONTENT

Mobile and internet penetration in India has exponentially increased over the last five years. The average Indian consumes 11GB+ of data every month. Access to affordable internet and data has fundamentally altered the way Indians consume news, entertainment, and everything in between. Cognizant of this paradigm shift, new-age media houses have a directed digital- and mobile-first strategy. These strategies enable them to not only optimize and find new ways of content delivery but also unlock novel models for consumer engagement, content creation, social media connectivity, building partnerships and revenue generation.

Here are two galvanizing entrepreneurs who have successfully deployed digital-only models in journalism and entertainment to build unique Indian media startups.

WOMEN ON THE FRONTLINES

1. YourStory: India's premier destination for entrepreneurship journeys
   Shradha Sharma - Founder and Editor-in-Chief

2. Pocket Aces: India's leading digital entertainment company solving boredom
   Aditi Shrivastava - Co-founder and CMO

YourStory Media: India's premier destination for entrepreneurship stories

Shradha Sharma - *Founder and Editor-in-Chief*

YourStory is often described as 'India's biggest and most definitive platform for startups and entrepreneur-related stories, news, resources and research reports. How did you envision this powerful idea of a new-age media house?

I have always been a strong believer in the power of stories. But when I saw early on in my career that traditional media firms only wanted to tell the stories of big brands and successful people, I felt an overwhelming need to give a voice to aspiring changemakers and entrepreneurs.

That is why I started YourStory in 2008, so that we can together make people's stories matter. So that we listen to people's stories and create a culture of listening, valuing and learning from each other.

Naturally, the stories I began telling were those of changemakers, entrepreneurs and innovators—people who wanted to change the status quo, people who had a hunger in them, a fire in their belly, an unending drive to do good, and yet very little means to do that when they started their journeys. I started by telling the stories of young doers, their dreams and hopes, and through them, inspiring so many more across the country.

I remember the many naysayers at the time, who told me YourStory will not work. They told me, "Who will be interested in stories of such unknown people?" And of course, the very important question that many people from across industries had: "How will you ever make money telling such stories?"

Still, I persisted. And over the past 12 years, we have told more than 100,000 stories—stories that inspire hope and innovation and ignite change. For more than a decade now I have tried to live by and find answers to these questions: How do you spread positivity in our thoughts and in our lives, when negativity is rampant and sells like hot cake? How do we make positive and inspirational storytelling a sustainable, revenue-making business model, at a time when sensational headlines and negative news are seen as the only operating models for media firms? How do you give a voice to people whose stories were never told because they were not successful enough? How do you make every story matter?

These were the questions that led me to start YourStory and these are the questions in my mind and heart that I am consistently trying to live by and find answers to with YourStory.

How has technology and digital media enabled your journey as a tech-entrepreneur? In your view, how are these new paradigms democratizing access to entrepreneurship?

I believe that like everything else technology and the internet have many strengths, creating many avenues for growth and new opportunities to innovate. At the same time, this can also give rise to a new set of challenges. But if there's one thing that technology can be credited for, it is of being an equaliser, creating opportunities for people from all walks of life to aspire and go on to do more than they could imagine in the pre-tech era. I believe I too would not have been able to create YourStory and reach so many millions of people if not for the democratising power of technology.

In the Indian startup ecosystem, I have seen first-hand the power of technology and digital media in creating a growing number of Indian entrepreneurs who've built global companies that have become household names across the world. Going forward too – particularly with the acceleration in digital adoption on account of the ongoing COVID-19 pandemic and the new normal of

contactless interactions – I believe that technology and digital media will play a more important role than ever before. This in turn will allow for more entrepreneurs to emerge from across the country, thanks to the removal of physical barriers and challenges in this truly flat world we live in today.

What advice would you give budding journalists and media enthusiasts on capitalising new opportunities in the digital era?

I would urge budding journalists and media enthusiasts to capitalise on new opportunities that continue to emerge in the digital era. You cannot not evolve as a journalist. You cannot afford to be rigid in your skills or your way of operating. You have to continuously learn. You must constantly be alert and pick up signals; you will realise that the signals come from the simplest of things, but the trick is in being open to change.

But most importantly, try to cut through the jargon and stand out from the clutter.

YourStory has a special segment called HerStory where you feature many rising stars of our time. What are some powerful trends you observe in the women in technology space that will make Indians proud?

Over the past decade, we have seen a growing number of Indian women rise to prominence. Many of their stories we have chronicled and celebrated on HerStory. While there is still scope for improvement in this area, I firmly believe that we will continue to see more and more women rise to prominence in the fields of science, technology, arts, and in business and entrepreneurship.

Already, we have had prominent and successful Indian women making a mark in the technology space. And this trend will continue. We have seen first-hand that women only need an entry into the playground; once that access to the playground is provided, once the infrastructure is made available, it will unleash an unprecedented growth in the number of successful women in technology and other areas.

Pocket Aces: India's leading digital entertainment company solving boredom

Aditi Shrivastava - Co-founder and CMO

Pocket Aces has captured the hearts of millions of Indians with hundreds of hours of relatable entertainment. What is your overarching mission and how do you retain the Indian consumer at the heart of it as you continue scaling?

Our mission is to solve boredom. What I love about this mission is that it is so unabashedly audience centric. This is what defines how we as a company think and take decisions, with a strong focus towards audience satisfaction.

Today we are India's largest digital entertainment company focused on mobile video, reaching over 50 million people a week and clocking over 700 million video views every month. To grow this in a robust manner, we need to do three things:

First, continue to remain highly relevant for various types of audiences at scale. We remain close to our audience by leveraging the fact that digital is a two-way medium. We apply design thinking principles to talk to the audience on an ongoing basis and gather insights on their evolving preferences and behaviours. This helps us decide what new formats to create, what new content genres to launch and what new platforms to develop a presence on.

Second, continue to grab audience attention minutes wherever they are spending time, across different platforms and mediums. In addition to building a strong presence on all social media platforms such as YouTube, Facebook, Instagram and Snapchat, and on OTT platforms such as Netflix, Amazon Prime, MXPlayer and SonyLiv, we also licence our content to other mediums such as television, in-flight entertainment, telecom companies and even to screens in cabs! This ensures that the audience find us wherever they want to be entertained.

Third, continue to experiment, reinvent and stay diversified. We are in extremely exciting times for the media and entertainment industry in India, so it is easy to become redundant or irrelevant quickly. To build to last, we are creating an ecosystem play with a fundamentally strong business having diversified offerings and revenue streams, capturing value across the value chain.

What is Pocket Aces' content creation philosophy and how do you utilise technology to drive it?

Our content creation philosophy is to create highly relatable content that the audience share, thus distributing it organically at a very low cost. This is what inherently makes a piece of content 'viral'.

Data and technology are at the heart of how we create content. Content has always been considered a 'hits driven' business led by the personal preferences of creators, but this cannot work at scale. By utilising insights from data and creating a feedback loop for creators, we have proven that we can reliably repeat the success and deliver viral videos week after week.

For our non-gaming content, we use tech tools to capture the usage behaviour and preferences of our audience on an ongoing basis. We use these tools to monitor the performance of released content and feed that data back into our creative process on a real time basis. We also leverage our access to these large audience sets to test concept ideas, themes, plot points, actors and the like with micro and short-form content before investing in creating more expensive, longer-form content. We also use proprietary tech tools to monitor trending content from across the world and predict the virality of content.

On our gaming app Loco, we have developed several cutting-edge technologies. One example is our low latency live streaming

technology that can support more than a million concurrent users. With this, we became India's largest live streaming app in 2018, second only to Hotstar. We also have an AI-driven recommendation engine that populates timelines with personalised gaming content. Loco's reward system and social buttons are another feature that ensure high engagement in the form of session times and retention rates.

Pocket Aces' range of content segments is astonishingly broad, from short animation memes to multiple-season web-series, and you have recently successfully ventured into the gaming world as well. How do you manage the whole spectrum?

We think of ourselves as a new-age digital media conglomerate. Just the way a traditional media company has channels across content genres and languages on TV, we are building these for a mobile-first audience. This manner of expansion is again a result of our audience-first mindset—India's diverse internet audience has a variety of entertainment needs and preferences, and we have done quite a bit of work to identify the gaps and areas that are still nascent in terms of behaviour creation.

You will see how our channels align with our mission of solving boredom as well as our philosophy of shareable content:

- FilterCopy (short video fiction) and Dice Media (multiple-season web series) are large general entertainment channels, focusing on everyday relatable situations and emotions of a broad Indian audience, while maintaining a progressive storytelling lens
- Our lifestyle channel Gobble focuses on content across the food, travel and home genres. These are highly engaged genres where the audience is not just searching for content and consuming it, but also creating a huge amount of user-generated content.
- Our infotainment channel Nutshell fulfills the Indian behaviour of continuously sharing knowledge with each other, even if it is on WhatsApp. We focus on 'did you know' and 'how it's made' kind of videos across history, sports, movies, technology and other topics that Indians love to share
- Our animation channel Jambo aims to eventually create the *Family Guy* or *South Park* of India. Animated content for adults is a big gap in India, and with Jambo we are specifically focused on the tier 2 and 3 Hindi belt audience and their sensibilities

- Loco is our most ambitious vertical since it is an independent app/platform. With fast, cheap smartphones and free data, Indians are finally gaming on their phones. This is a brand-new content sector, and hence it is possible to shape this behaviour and become the platform of choice. Gaming is also very interesting as a content genre because of its high repeat value—if you like a movie or show, you will watch it a few times as best, but if you like a game, you will play it thousands of times. It directly feeds into our mission of solving boredom and capturing maximum attention minutes.

Having several channels is extremely synergistic from a business perspective as well—while each channel has its own creative team, all other functions, such as sales, marketing, talent, finance and HR, are shared. Having different types of content and audiences also empowers us to offer a diverse suite of solutions to advertisers, thus making us the partner of choice for all kinds of marketing campaigns.

How has India's technology ecosystem enabled you to build and scale Pocket Aces in ways that would not have been possible even a decade ago?

Until a few years ago, easy data access was considered a luxury, mainly used by people living in metro and tier 1 cities. But with two huge technology and infrastructure advances—cheap high-quality smartphones and almost free data—the internet is quickly becoming an equaliser in the growth of India and Bharat alike. Today, there are over 480 million people in India that have access to the internet. Reports show that 45 percent of internet usage is for social media and entertainment, and 75 percent of this consumption is happening via the mobile phone.

An average Indian is picking up their phone 35 times a day, for seven minutes each—that is 4 hours a day. They are bored, they are hungry for entertainment. And the nature of this boredom is evolving quickly. In addition to just passively consuming content, they now want to build their social personas, share their opinions, show off their talents, keep in touch with friends and even earn money.

Pocket Aces is solving this boredom and earning these attention minutes by entertaining everyone, everywhere, every day.

About the Authors

Shradha Sharma is the Founder and CEO of YourStory. Shradha founded YourStory as a digital storytelling platform for entrepreneurs and startups in 2008, leaving behind a lucrative job at a top national media company, solely because she believed India's new-age entrepreneurs deserved to have their stories told, something that mainstream media was not ready to do at the time. Shradha was on Fortune's list of the best 40 under 40 entrepreneurs in India for three years in a row. In 2018, she won the Forbes Power Trailblazers award and the FICCI Flow Young Women Achiever Award, among others. She was twice featured on LinkedIn's list of powerful influencers, after Prime Minister Narendra Modi and actor Priyanka Chopra.

Aditi Shrivastava is part of the founding team at Pocket Aces. Aditi spent over five years at Goldman Sachs in New York, after graduating magna cum laude from Princeton University. She is a CFA (USA) charter holder, a Shaper in the World Economic Forum Global Shaper Mumbai Hub, and a TiE Mumbai Charter Member. Aditi is passionate about problem solving, dance and travel. She calls Kuwait (where she grew up) and Mumbai (where she currently resides) home.

5

EDUCATION TECH

A world-class education system has three pillars – quality, affordability and equity of access. With unprecedented digital and mobile penetration, India is at the cusp of utilizing digital platforms to enable all three pillars of education for every Indian child and youth. One, this is a promising way to educate and upskill India's large young population. States with the largest young populations like Bihar and Rajasthan, have the lowest college and teaching infrastructure. The use of digital platforms can help leapfrog the need for building physical infrastructure. Two, with the future hinged on the knowledge economy and human capital development, it is all the more essential to ensure our young population has access to and are trained in deep sciences and frontier technologies like artificial intelligence, machine learning, and others.

Here are three spirited entrepreneurs who are training India's future generations by deploying proprietary digital platforms at scale.

WOMEN ON THE FRONTLINES

1. BYJU'S: World's most highly valued ed-tech and digital learning company
   Divya Gokulnath - Co-founder

2. Uable: Creativity-focused skill development in the 6-14 age group for next-gen leadership
   Priyanka Subramanian – Chief Learning Officer and Founding team member

3. Practically: Delivering immersive learning and 3D virtual classroom experiences
   Charu Noheria – Co-founder and Chief Business Officer

BYJU'S: World's most highly valued ed-tech and digital learning company

Divya Gokulnath - *Co-founder*

How did BYJU'S go from a 25-person physical classroom for test prep to the world's most highly valued education-technology (edtech) company in the span of a decade?

For us at BYJU'S, it was a clear case of passion intersecting with real needs. Our mission was to make learning accessible, effective, engaging and personalised for all students. We wanted to leverage technology and the intrinsic curiosity of students and help them become active and self-sufficient learners. Even when BYJU'S classes operated at an offline premise, its popularity grew exponentially. BYJU'S took the shape of test-prep classes that grew to wo rkshops for 100 students to auditoriums with over 100 students, which further scaled up to stadium sessions for over 20,000 students.

During this phase, the team at BYJU'S travelled across the country to make quality education accessible to all students. Soon we realised that our education system was faced with three major challenges—the lack of access to quality teachers and quality content, the lack of personalisation in a traditional learning environment and learning in students being driven by the fear of exams instead of a love for learning.

We understood that to make a real impact on the way students learn, we need to start early—when students are grappling with fundamentals, as these are the crucial years that lay the strong foundation for lifelong learning. Think & Learn Pvt Ltd (the parent company of BYJU'S) was launched in 2011 with a focus on the K-12 segment. Consequently, we launched our flagship product, BYJU'S-The Learning App, in August 2015. Between 2011 to 2015, we worked and developed the idea of making quality learning accessible for everyone in the form of an app. Instead of focusing on how teachers teach or what parents expect from the app, we focused on what the students need to learn effectively.

Today, as India's most loved school learning app and the world's most valuable edtech company, we are working on building personalised learning experiences for students. Every student's learning requirements are unique; our learning programmes have been designed to adapt to the learning needs of each student as per their style, pace and size of learning.

The key reason behind BYJU'S 'relative' success in the edtech space is the value it adds to the lives of its students. Today, we have 64 million app downloads, 4.2 million annual paid subscribers and an annual renewal of 85 percent. These numbers are a testament to the fact that students are enjoying the BYJU'S way of learning. However, we have just scratched the surface and have a long way to go before we call it a revolution

How has India's technology ecosystem enabled you to scale BYJU'S in ways that would not have been possible here even a decade ago?

BYJU'S is and has been a digital-first company for a decade now. Technology has played a crucial role in shaping our journey to success and it continues to take great precedence in all our current endeavours. During our initial days, when BYJU'S took the shape of an offline test-prep class, our biggest hurdle was making quality learning accessible to students across the country. Our team would travel across the country and teach classes in stadiums filled with enthusiastic students. In 2009, BYJU'S launched online video-based learning for CAT through VSAT. This was a revolutionary step for us and was the first time that we used technology as an enabler to help scale our operation.

We have come a long way since then. With the help of our learning app, we have been able to innovate the way subjects like math and science are being taught, and personalise learning based on the individual capability of each student. The right blend of technology in our systems enables us to

create personalised learning paths for our students, offer highly relevant recommendations, predict and solve their 'real' learning challenges. Our other important focus has been to use game design principles that are about fundamental human psychology and behaviour and drives certain reactions and outcomes from students.

The increasing smartphone and internet penetration in India have boosted the growth and adoption of online learning. According to several reports, today 70 percent of students in India have access to a smartphone and this is only expected to increase exponentially. Smartphones have an infinite reach and an incredible opportunity to impact learning outcomes of students across India. The affordability and ease of use have made smartphones a household device. In addition to this, screens have become the primary mode of content consumption for the young generation who now use technology, smartphones, tablets and computers naturally. Smartphones also reduce the disparity between students from metros and those from smaller towns by providing them with equal and personalised learning opportunities along with access to the best teachers from around the world.

While the digital divide is still a challenge, the inequities and disparities that exist in the physical world are a much bigger hurdle to solve. Just a small section of students has access to good schools and good teachers while the majority do not have access to quality education. Our best chance to solve this at scale is by using technology as an enabler with smartphones as a distribution medium so that high quality content is accessible to students across geographical locations.

BYJU'S has made a series of strategic acquisitions and collaborations that have massively expanded its reach and unlocked new models of content delivery. What is your philosophy with these business strategies? As a teacher in a tech-enabled world, how do you envision using digital platforms to capture the minds of the next generation and deliver premium learning content straight to their eyeballs?

At BYJU'S, our vision is to make students fall in love with learning. Learning is the most integral defining part of childhood. In the years that I have spent creating learning experiences for children across ages, I have realised that there are limitless avenues for children to learn from. Books, movies, videos, television and the internet are some of the most dynamic mediums that aid a child's learning. BYJU'S has managed to integrate these avenues through unique movie-like videos and gamified content that are tailor-made for students across age groups. We leverage technology to explain concepts contextually and visually to students.

Unlike a conventional classroom learning environment, a tech-enabled learning system allows you to reach students in every nook and corner of the country. The availability of data on the learning patterns of students allows for personalised feedback and assessment. 'Knowledge Graphs,' the brain of our learning system, makes this more effective. It is a graphical representation of how different concepts are related to each other and can direct the learning journey of a student by pointing them to the relevant concepts or information based on what they are learning at that time. This allows students to access our content at their own pace, get personalised recommendations based on their previous learning patterns and truly fall in love with learning. We have brought the ideal 1:1 teacher-student classroom experience to a more convenient form on mobiles or tablets. The device they use adapts to their level of understanding, understands their learning gaps and addresses those gaps by recommending the next set of videos to watch or tests to take.

In addition to this, today, screens have become the primary mode of content consumption for the young generation. With a screen, every student has a front row seat in the virtual classroom and there are no backbenchers. This new generation uses technology, smartphones, tablets, and computers naturally. They learn their first alphabets and numbers from the screens. At BYJU'S, we use the same format (screens) that kids use for entertainment and games and present learning content in the same medium.

As a teacher, technology has empowered me to be better. And I strongly believe that the future of education will essentially see technology create an integrated learning platform that will be an one-stop solution for students, teachers and parents alike. The proliferation of smart devices coupled with the democratisation of the internet will lead to blended learning, which will bring the best from traditional and virtual classrooms. The 'classrooms of tomorrow' will have technology at their core, empowering students to cross over from passive to active learning. The future will see us take a leap from the traditional one-to-many approach to blended one-on-one learning experiences, providing students the best of both physical and digital worlds. With technology as the backbone, we can create the 'real global classroom' where irrespective of their geographical location, school infrastructure and proficiency levels, students will be able to access quality education through integrated learning platforms.

How are you constantly evolving at BYJU'S, with the ongoing pandemic and series of strategic acquisitions and collaborations?

We are an extremely agile organisation. We have constantly disrupted our own business model and strategies to create an even bigger impact. The ongoing pandemic has presented us with an opportunity to innovate and adapt to new circumstances. With students completely dependent on online learning, we witnessed over 15 million new students using BYJU'S in April and May. Additionally, we witnessed a mindset shift in parents in favour of online learning. Our own research showed that over 75 percent of

parents whose children turned to online learning wanted them to continue to do so even after schools reopen.

We proactively responded to the situation and adjusted our short-term goals, while our long-term vision of making students fall in love with learning remained intact. With acceleration in the acceptance of online learning, we accelerated the launch of new products, such as our live classes, which were made available for free in April. While it was initially to be launched later this year, we realised the value of bringing such scheduled learning into the lives of our students during the lockdown. We have also launched learning programmes for history, civics and geography. We have made our learning programmes available in almost every vernacular language in the country. We also recently launched learning programs for students in upper kindergarten and lower kindergarten.

Given the fragmented nature of the private tuition sector in India, we also launched BYJU'S Classes, a comprehensive after-school learning solution for students across the country. With this, students now have access to scheduled online classes from India's best teachers, instant doubt resolution and one-on-one guidance from dedicated mentors, all from the comfort and safety of their homes. The fact that these launches could happen with all our teams working remotely from home is a testament to the efficiency of India's tech-enabled ecosystem.

The focus of our acquisitions and collaborations, too, has always been to strengthen our offerings and create holistic learning experiences on a single platform. Early last year, we acquired Osmo, a Palo Alto-based learning games company and we have now acquired the popular coding platform White Hat Jr. Increasing engagement and making students enjoy learning has also been a big component of our strategy. Our acquisitions have catered to our mission and long-term vision. The one question we ask ourselves is if it will be useful to students and if it will be used by students. This is the most fundamental part of our evaluation process. Overall, the focus has always been about coming together and creating something better for our learners.

Uable: Creativity-focused skill development in the 6-14 age group for next-gen leadership

Priyanka Subramanian - Chief Learning Officer and Founding team member

Uable's focus on the 6-14 age group aims at developing the leaders of the next generation. Tell us how Uable is leveraging technology to achieve this.

Uable in a learning company that is enabled by technology. Our vision is not to just use technology to make learning scalable but to leverage technology to enhance learning. Uable's learners are all between the ages of six and 14 years, they are all digital natives, and naturally fascinated and comfortable with technology. We aim to build an online learning playground that exercises and celebrates creative intelligence.

We use the unique power of technology to provoke a learner's imagination, build a sense of wonder, develop deep understanding and enable creation that pushes learners to exceed beyond expectations. A Uable learning experience does not have a learner sit in front of a device and passively consume content. Our learners are engaged in active, immersive learning experiences where they are creating, exploring and connecting with peers.

Research has proven that every child learns and expresses their learning differently. We focus on using tech-based tools to allow learners various opportunities and personalised pathways to engage with the learning process so that every learner can achieve their maximum potential. While we recognise that learning pathways need to be personalised, we also believe that learning is inherently social in nature. Hence, we are using technology to build a connected community that learns, creates and celebrates creative intelligence.

Uable is a social learning product that builds real world skills that lead to the development and harnessing of one's creative intelligence. We are doing this by creating:

- Live online peer learning environments where learners engage in real life roles and build skills to become future ready
- Asynchronous tech-based DIY activities, challenges and quests that enable learners to continue on their learning pathways, develop their skills further and amplify their learning
- Creative intelligence skill-based assessments and benchmarking, designed to objectively benchmark, track and measure creative intelligence across various domains
- An online connected community where learners can showcase their creations to likeminded peers, educators and experts from across fields

You come from a non-technical background but are creating 360-degree learning experiences with the use of scalable technology platforms. How did you embark on the technical path and what advice do you have for others endeavouring the same?

Yes, I do not possess a formal degree in technology, but technology has always been a friend to me. As a visual designer in the advertising industry, my tryst with technology began by understanding how it can enable the sharing of one's creative vision with the world. As I grew professionally, my connection with technology grew stronger and most of my understanding is through very practical, learning-by-doing experiences.

My shift from visual design to education happened when I was offered an opportunity to be a fellow at Teach For India, a non-profit organisation that is part of the Teach for All network. I started off as a class teacher to an enthusiastic bunch of eight- and nine-year-olds in a Mumbai municipal school. Teach for India is geared towards ending education inequality in the country, but this audacious undertaking cannot be achieved without looking

at scalable solutions. While I was a teacher in physical classrooms, all the learning was measured, tracked and gauged using tech-based tools. I was introduced to the methodology of data driven instruction, which helped identify where learning gaps existed and what can be done to bring students at par with expected learning standards. This led to achieving great success in pushing my students' learning levels and bringing them up to grade level and some went even beyond expectation.

One of my strong takeaways from my first few years in the education field was that learning gaps exist all across the socio-economic spectrum, from low-income to high-income schools, and one of the challenges faced by most education institutions is how to identify these challenges early on for every child so it can be handled in a timely manner. Addressing this problem at scale can only be achieved through technology. This was when I made the decision to move into the education-technology space. My experience with educational initiatives introduced me to the various facets of tech driven learning and assessments. I applied all my learning when I worked on building the K12 assessment product at Pearson India. Our approach to tech-based formative and summative assessments tagged to the Blooms Taxonomy helped teachers, parents and students identify strengths and areas for improvement in learners, and we were able to showcase how our learning experiences were impacting learner achievement.

We at Uable are taking the 360-degree product approach to solve one of the most ignored problems in K12 learning today. We aim to harness the creative intelligence in a child and grow it to its maximum potential. We aim to not just look at how learners are faring on their evaluation but to dig deeper and innovate at every stage of the learning process from why they need to learn something, what they are learning, how they are learning, how much learning is being retained and how they are applying their learning in creative and inventive ways.

What lessons do you share for fellow entrepreneurs who want to Make in India and deliver world-class digital learning experiences to domestic and international customers?

I personally think this is a glorious time for Make in India. We are privileged to have some of the greatest and sharpest minds the world has to offer. India has such a diverse demographic that it is slowly but surely becoming a representation of the global market. As entrepreneurs in India, we are put through the grind to build products that can work in various unpredictable conditions, suit multiple use cases, and that cater to various needs. This diverse but deep approach to product building is what sets us apart from the lot.

My strongest learning has been that one needs to stay close to the consumer no matter how fast you scale or how large you become.

While we as entrepreneurs keep innovating to make our products and services more and more sticky, usable and scalable, it's important to take your customer along on this journey of change.

Another learning that has stuck with me is that a lot of what a company can achieve is driven by the people you work with. Having a strong, diverse and ambitious team is what makes and breaks any company. Working with people who can be thought partners and thought leaders can be a catalyst for every company.

I am still very early in my entrepreneurial journey with Uable but every single day brings in new learnings and new perspectives. Having an agile approach and a growth mindset keeps me moving at through thick and thin.

Uable advocates the idea of creative intelligence, especially with the advent of artificial intelligence and a new era where routine jobs are becoming automated. How do you envision using creative intelligence as a metric to drive human capital development in India and beyond?

The gaps that so many studies like NASA's creative genius study (which concludes that creative genius of humans fall from 98 percent at the age of six to two percent by the time we are 18) and experts like Sir Ken Robinson (in his famous TED Talk) have highlighted for years are now being recognised, and India appears to be taking progressive steps to address it.

Our greatest joy in recent times has been seeing India's New Education Policy (NEP) lifting off the ground. The NEP aims to bring in a more progressive and holistic approach to learning. It aims to bring creativity and innovativeness to learning to prepare children for life outside the classroom and focus on building important skills such as collaboration, creative thinking, problem-solving and logical reasoning, which have been neglected until now. The NEP notes, "Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centred, discussion-based, flexible, and, of course, enjoyable." The NEP is a validation of how creative intelligence is going to be one of the most fundamental and differentiating factors in ensuring the learners of today are geared towards achieving success in the future.

At Uable, we have designed a framework that can access, measure and grow a child's creative intelligence. We aim to provide every learner with a personalised pathway to explore, develop and converge their skills in a way that will help them identify their own strengths and interests, eventually leading to making more aware decisions while selecting career pathways. This approach is developmentally informed and ensures that a child has clarity about his/her creative intelligence:

■ **Stage-1: 6-9 years (The early years: Exploration and skill development)**

This is the age when cognitive development is manifesting and about to hit its peak, and children are ready for exposure and skill development. This is the time when children start to learn from diverse peers, which is essential for holistic development and exploration. At Uable, they explore various real life roles like being an artist, author, performer, experimenter, inventor or coder, with a focus on developing fundamental skills.

■ **Stage-2: 10-12 years (The mid-years: Advanced skills and deeper exploration towards interest development)**

During this stage, Uable's programmes and progressions help children focus on certain interest areas, take up accelerated/advanced pathways to develop those interests and a portfolio of work with ownership and autonomy.

■ **Stage-3: 13-15 years (Career exploration, mentoring, internships)**

As soon as a child enters the eighth or ninth grade, they are confronted with the same question from parents, peers and others—"What career path do you want to pursue?" At Uable, we believe everyone should always be free to explore further and change pathways, but some decisions taken at this age are likely to orient them towards certain career paths, universities and entrance exams. This can prove to be pivotal in defining how life unfolds hereon for them. During this stage, children go through advanced programmes on roles that suit their creative potential. They engage with deeper projects to build a stronger portfolio of work and connect with mentors in these selected areas to understand their own likes and dislikes well.

We believe that our approach of building a child's creative intelligence and skill development through real life roles, and building a strong sense of self and community through our social, active learning pedagogy will result in confident, self-aware and entrepreneurial youth in the future.

Practically: Delivering immersive learning and 3D virtual classroom experiences

Charu Noheria - *Co-founder and Chief Business Officer*

How is Practically changing the paradigm of education delivery?

As you can tell from our name, Practically approaches education from a very practical perspective. Practically is an immersive learning app that focuses on delivering learning via experiences. Learning is all around us, it has no limits and is effortless. Learning intertwined with immersive storytelling and real-life examples increases the retention of concepts by over 90 percent after two weeks of learning as compared to about 30 percent using traditional methods of teaching and learning. Practically delivers interactive experiences like simulations, augmented reality content and virtual reality progressive learning sets to make learning fun and sticky. We are pleased to see that our approach and philosophy towards limitless learning found a place in the new National Education Policy, which emphasises on experiential learning. This will be foundational for the next generation of learners to forge the future of India. Practically also helps teachers conduct the most engaging and experiential classes online. Teachers can 'practically' do everything in a Practically virtual class that they do in a physical classroom, only better.

How are you using frontier technologies like artificial intelligence (AI), augmented reality (AR), virtual reality (VR) and others to make learning exciting?

I was in Dubai earlier this year and students there have generally not seen apple and mango orchards as they are not grown locally in the Middle East. When they used Practically's VR experience of them picking any seed and throwing it into the garden to then see it into full blown trees, they were thrilled. Imagine breaking apart all the bones of a life-size skeletal system and putting them back like a puzzle in an AR simulation. The adrenaline rush learners get while experiencing such activities is mind blowing. Practically uses reality technologies like AR and VR to bring life

to learning. We also have an AI chatbot that the learner can count on to assist in their learning when the teacher is not around, like a study buddy. Our chatbot is conversational and is a knowledge powerhouse covering a wide range of academic topics and general knowledge. We also use AI to constantly monitor attentiveness levels in a virtual classroom for instantaneous feedback, alerting the teacher, to make sure the class is engaged, interactive and energetic.

Tell us how you have successfully expanded into global markets while driving a Make in India innovation initiative, and what is next on your agenda.

Practically launched in India amidst the lockdown in April. The product has been very well received by all category of schools in India. Our experiential virtual classroom solution has been a mega hit with teachers. Building on this success, we have launched Practically in the West Asia and Southeast Asia markets as well and have also started onboarding some large prestigious school brands as customers and regional partners. The Gulf Cooperation Council region is turning out to be a great place for us to invest and scale our operations. Practically's immersive animated video content can be easily localised into any language. Although the near-term plan is to expand into other English-speaking countries globally, we are also exploring with partners in countries where there is a need for content in another language.

How are you helping teachers and parents step into a new digital reality, particularly with the COVID-19 pandemic?

Imagine learners doing physics and chemistry lab experiments from the comfort of their house at zero cost. Imagine teacher guiding students through an experience of creating a polymer, molecule by molecule. Imagine teachers and students being

connected via a digital platform where the engagement level is at par or more than a physical classroom. The Practically experience is unique in many ways and demonstrates that 'school from home' is both easy and fun. Teachers and parents are no longer fighting for phones and tablets to be thrown away but are now proponents of using technology for all learning activities. At Practically, we have enabled teachers to continue teaching during these tough times. The teacher's role is redefined thanks to the pandemic; teachers are stepping into the shoes of a facilitator, mentor, guide, entertainer, innovator, counsellor and much more. With Practically, these new-age teachers are embracing technology with ease and experimenting with newer ways of teaching, using experiential methods.
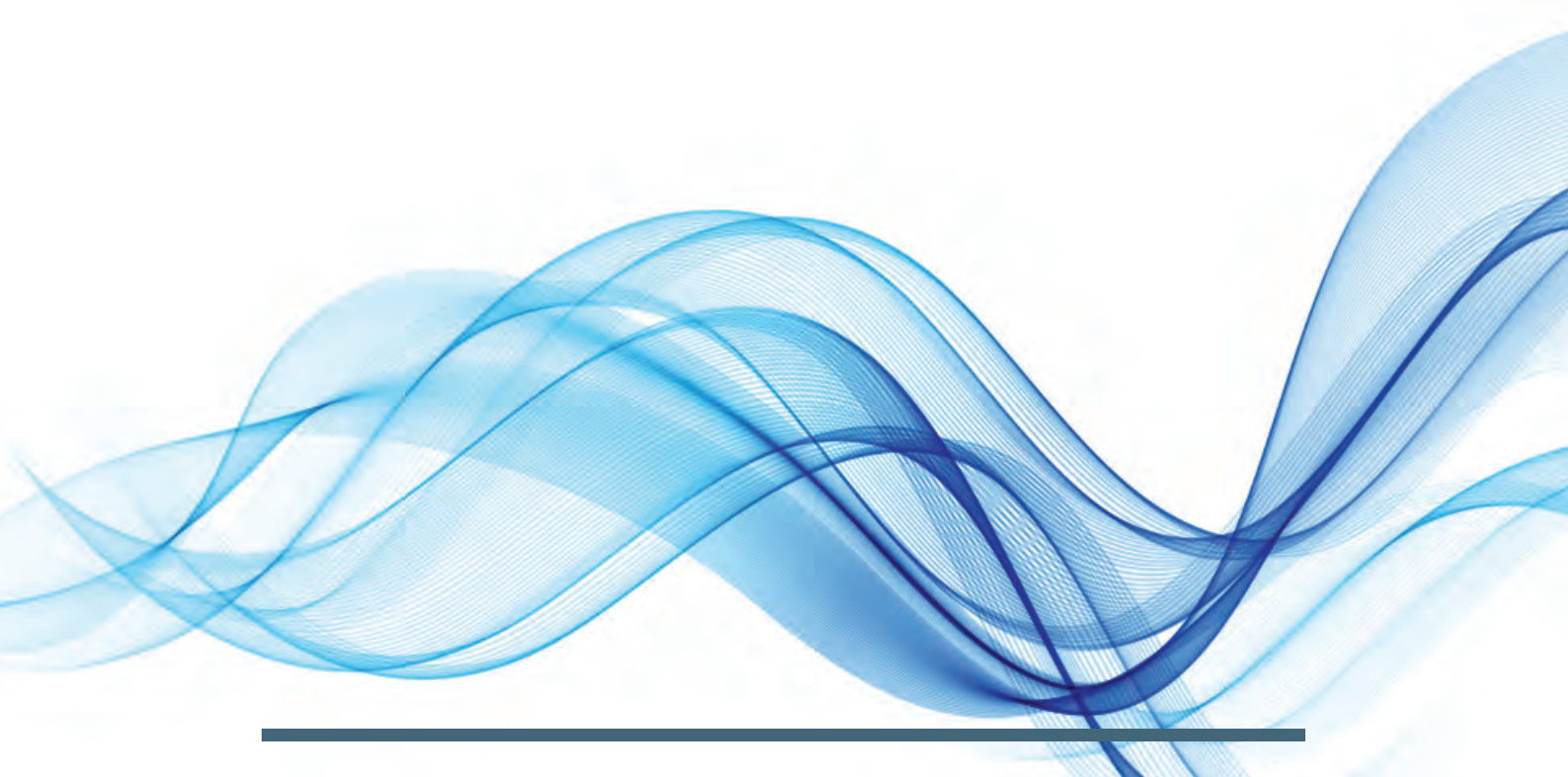
About the Authors

Divya Gokulnath is the Co-Founder at BYJU'S, the world's most valued Edtech company. Since inception, her focus has been to create unique and personalized learning experiences for students across grades. Apart from being on the board of BYJU'S, she leads functional teams across Content, User Experience and Brand Marketing. Winner of Business Today's Most Powerful Women 2019 award and LinkedIn Top Voices in Education (India and Global), Divya is a strong advocate of cherishing childlike curiosity. She believes that it is this curiosity and willingness to explore that can make better learners for a brighter tomorrow. A university rank holder from R V College of Engineering, Bangalore, Divya is continuously working towards reinventing the concept of learning among school students in India.

Priyanka Subramanian has been an educator for the past 10 years, especially focusing on enhancing the K-12, ed-tech sector. She started her journey in education with Teach for India, non-profit education organisation aimed at ending education inequality in India. Over the years she moved from non-profit and focused on ed-tech, working with companies like Educational Initiatives and Pearson Education to create scalable, quality learning solutions to positively impact the field of education in India and other developing countries. As part of the founding team and Chief Learning Officer at Uable, Priyanka aims to build a company that is deeply invested in growing Creative Intelligence in young learners across the world by creating 360 degree technology driven, highly engaging learning solutions.

Charu Noheria is an entrepreneur, and has co-founded two companies in the edtech space--3rdFlix and Corsalite. She did her bachelor's in engineering (computer science) from RV College of Engineering, Bangalore, and has an MBA degree from the University of Illinois-Urbana Champaign. Her passion for education stems from her personal experience of being part of the rat race for qualifying in competitive examinations in India, leading her to switch five engineering disciplines in three engineering colleges.

India is witnessing two pivotal women-centric phenomena at this time: the unparalleled inclusion of women in the Indian economy, and their growing role at the frontiers of technology development. This report aims to showcase women at the cutting edge of developing and deploying technology and to highlight both their professional achievements and their individual stories.

We start with four trailblazers, who started working in technology when it was a relatively new field in India and, in a time that was far less welcoming to women. The women we include have led the development of technology, as well as the enabling ecosystem of governance, policy and finance. We then showcase the leaders of tomorrow, women who have founded and built companies at the cutting-edge of technology across a range of segments—finance, data analytics, media, scientific innovation and education.

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