

TECHNOLOGY

adding fuel to

DRIVE OUT

COVID-19



The pressure on the healthcare sector to provide a solution for the COVID-19 pandemic is massive. As a result, the life sciences sector is adopting new technologies to quickly devise a way out to beat this crisis. Many companies and academic institutions in India are moving headfirst in this direction with support from the technology sector both locally and globally. Technology adoption is indeed playing a key role in better understanding and addressing the crisis with the right amount of fuel being added by the tech giants.

The big technology companies across the globe have complete dominance in their respective sectors such as communication, social media, e-commerce, etc. Due to their dominance in the technology market, the big techs also influence the economy and society. These companies are shaping the way our society is progressing. The products and services offered by big techs are used by hundreds of millions all over the world.

Of late, these tech giants are leveraging their strengths in data and user-friendly platforms to create new solutions in healthcare as well. The biggest push from technology came a few weeks ago when Google announced an investment of \$10 billion in India in the next five to seven years, leveraging technology and artificial intelligence (AI) for healthcare, education and agriculture.

Digital disruption has reached the healthcare sector, and with it comes an imperative for life science companies to retool core technology to remain competitive. While there is still debate around

the scale and pace of change this will bring for the life sciences industry, there is little doubt that the change is well under way.

This digital disruption has become all the more prominent due to the ongoing COVID-19 outbreak. The pressure on the healthcare sector to provide a solution for this pandemic is massive. As a result, the life sciences sector is adopting new technologies to quickly devise a way out to beat this crisis.

Many companies and academic institutions in India are moving headfirst in this direction currently with support from the technology sector both locally and globally. They are bringing advances in data, genomics and diagnostics together, as well as new methods, technologies and therapeutics to meet the ongoing needs.

"Healthcare is a notoriously conservative industry. However, the current situation has accelerated the inevitable evolution and rapid adoption of technological innovations. Robotic process automations and artificial intelligence can

help cost optimization and consolidation of services at the back-end, whereas the human workforce can be channelled into higher demand and strategically important areas", says Viren Shetty, Executive Director and Group Chief Operating Officer, Narayana Health, Bengaluru.

In-house tech support

One of the very first announcements of a collaboration with a technology company to combat the pandemic, came from the Bengaluru based Indian multinational corporation Wipro. The company's strategic initiative into the future of manufacturing, Wipro 3D is working with Thiruvananthapuram based Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) to jointly build up on a prototype of an emergency ventilator system based on Artificial Manual Breathing Unit (AMBU), developed by SCTIMST.

"Millions of people worldwide are affected by COVID-19, and the numbers are increasing at a very fast rate. In this alarming situation, a handy artificial manual breathing unit will be very helpful. Wipro 3D responded to the Expression of Interest (Eoi) invited by SCTIMST. We held an elaborate discussion with technical teams and assessed the prototype. We intend to quickly move into clinical trials and then manufacturing it through Wipro 3D," shares Dr Asha Kishore, Director, SCTIMST, Thiruvananthapuram.

Mumbai based Larsen & Toubro, a major Indian technology and engineering company, is contributing in this fight against COVID-19 by using new technologies, AI and its digital platforms to support local authorities in 20 cities so that they can monitor and implement measures to help combat the spread of COVID-19. The company has partnered with

municipal and police agencies to set up technology and manage command and control centres or operations centres in cities such as Mumbai, Pune, Nagpur, Prayagraj, Ahmedabad, Visakhapatnam, and Hyderabad.

Following the suit, Mumbai based technology company, Hexaware has rolled out a cloud-based quarantine zone care management software solution and mobile application called KareRing that provides institutional care providers a care management dashboard, quarantine zone tracking and reporting facility.

"Healthcare organizations, community hospitals, governments, NGOs, law enforcers, communities, enterprises and care providers can use the KareRing solution to not only manage and limit the outbreak but also provide timely care management to those in quarantine. Using the application command centre, the care providers can seamlessly on-board personal, provide efficient safe zones management, symptom management, care tracking and response management. Solution provides configurable rules for care alerts and



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user off-boarding. Solution helps identify clusters and control breach scenarios through geo-tracking. The to-be-quarantined user is required to download the application on his Android or iOS mobile device for smooth tracking and health management”, explains R Srikrishna, Chief Executive Officer, Hecaware, Mumbai.

Global participation

American multinational enterprise Hewlett Packard (HPE) has stepped in by deploying four COVID-19 test labs and four outpatient department (OPD) centres across the country to assist the central and state governments in their efforts to contain the COVID-19 pandemic. These facilities, in Delhi, Chennai, Lucknow, and Dehradun, have been set up to provide additional authorised testing facilities and isolation beds to manage the increased demand across the country. This effort by HPE is being supported by the National Association of Software and Service Companies (NASSCOM).

HPE has developed and deployed these test Labs and OPD centres in 40-foot refurbished negative air pressure containers equipped with biometrics, blood pressure apparatus, spirometer, serum analyser, pulse oxymeter, glucometer,

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pulse reader etc. To ensure the IT infrastructure at the test labs and OPD centres experience minimal downtime and any related issues can be rectified remotely without the need of an on-site engineer, the facilities are equipped with Aruba Cloud Managed Wireless solution along with Aruba User Experience Insight (UXI) sensor.

“COVID-19 has thrown unprecedented challenges for the world and industries alike and we must actively implement various measures to help contain the virus. NASSCOM is working with the IT industry in formulating innovative solutions to combat the pandemic. Cloud-enabled HPE COVID-19 test Labs and OPDs will enable authorities to refine their testing process and will significantly reduce the strain on existing healthcare facilities. We are confident that together we will be able to overcome this phase and emerge stronger post the crisis,” shares Debjani Ghosh, President, NASSCOM, Gurugram.

On the other hand, American multinational technology company IBM has provided its Watson virtual agent to the government agencies, healthcare organizations and academic institutions for generating COVID-19 related information.

The Watson Assistant for Citizens leverages currently available data from





"Researchers at IIT Delhi are leading a critical effort to develop low cost diagnostic solutions that will make COVID-19 testing much more affordable and accessible for all."

- **ROHINI SRIVATHSA**,
National Technology Officer,
Microsoft India, Bengaluru



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- **PROF. TG SITHARAM**,
Director, IIT Guwahati



external sources, which include the Ministry of Health and Family Welfare and other government sources for prevention and treatment related guidance, citizen welfare schemes in India, as well as global resources such as World Health Organization (WHO) and U.S. Centers for Disease Control & Prevention (CDC). IBM already is delivering this service across the United States, as well as engaging with organizations globally in Czech Republic, Finland, Greece, Italy, Poland, Spain and more.

"In just the last few months, the COVID-19 coronavirus pandemic has altered nearly every aspect of our personal and professional lives. In these challenging times, it's critical to offer accurate information to all constituents and hence a clear opportunity to apply artificial intelligence to quickly answer common questions at a very large scale. IBM developed the Watson Assistant for Citizens to provide an AI-powered virtual agent that helps governments deliver accurate information to their citizens without overwhelming contact centres where human agents are needed to help those who truly need them. To introduce this offering in India, IBM Research has trained Watson Assistant to answer queries in English and Hindi to enable various government agencies and departments to offer this service to its constituents", shares Gargi Dasgupta, Director, IBM Research India & Chief Technology

IITs & COVID-19 PROJECTS		
S.No	Institute	COVID-19 projects/products
1	IIT Madras	Nano coated filter media, Wearable symptom tracker, Portable hospital unit, Remote patient monitoring device
2	IIT Delhi	Diagnostic test, Anti-viral nano coating, Vaccine, Face mask, PPE coverall, Hand sanitiser
3	IIT Bombay	Nasal passage gel, Digital stethoscope
4	IIT Kanpur	Vaccine, Disinfectant, Deodorant based sanitiser, Ventilator, Face mask, Disinfectant tunnel, Drug repurposing, Positive Pressure Respirator System, PPE coverall, Anti-viral nasal filter
5	IIT Kharagpur	Vaccine, Predictive model, Diagnostic test, AI based system for social distancing
6	IIT Roorkee	Drug repurposing, Respirator, UV disinfectant, Face mask and shield, Diagnostic test, Ventilator, Herbal sanitiser, Rapid testing software, Screening booth
7	IIT Guwahati	Diagnostic test, Predictive modelling, Vaccine, Antimicrobial spray-based coating, Robots, Face masks and shield, Fever tester, Hand sanitiser, Ventilator
8	IIT Hyderabad	Bag valve mask, Hand sanitizer, Vaccine, Face mask and shield, Protective wear, Ventilator, Smart wearable patch, Drug repurposing, Air purifier, Diagnostic test, Cough simulator, Lithium batteries
9	IIT (BHU) Varanasi	Anti-microbial five layered face mask, Drug repurposing
10	IIT Dharwad	Disinfection chamber, Anti-viral nano coating, 3D printed adaptor for ventilators
11	IIT Bhubaneswar	Ventilators
12	IIT Gandhinagar	AI tool for chest x-rays
13	IIT Roper	Ventilators, AI vehicles, Infrared vision system, Wardbot, Portable negative pressure rooms
14	IIT Patna	Face shields
15	IIT Mandi	Disinfection box, Foot-operated hand Sanitiser Dispenser, Portable ventilator
16	IIT Jodhpur	Therapeutic solutions, Face masks and shields, AI based diagnostic system, Anti-microbial coating, UV steriliser, Monitoring gadget
17	IIT Tirupur	Online awareness games
18	IIT Bhubai	Face Masks, Swabs
19	IIT Goa	Drug, Diagnostic test
20	IIT Jammu	Face shields
21	IIT Dharwad	3D printed Face shields
22	IIT Palakkad	Automated lung ultrasound
23	IIT Indore	Face mask, UV chamber, Temperature sensor

Officer, IBM India /South Asia, Bengaluru.

A similar initiative has been carried out by the American multinational technology company Microsoft Corporation in the form of Bing COVID-19 tracker. It allows users to track COVID-19 infections across the globe and in India at a hyperlocal level. Users can get statistics on infection, recoveries and fatalities in their own states and districts. They can also save locations of their near and dear ones to quickly view stats of those areas at one place.

It has integrated Apollo Hospitals bot for self-assessment and a hub for telemedicine support from reputed healthcare organizations. The tracker offers content in nine Indian languages to provide people across the country access to critical information related to the pandemic in preferred language.

However, Microsoft and IBM are not the only ones



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Chief Executive Officer, Hexaware, Mumbai



"The MediCAB is foldable and is composed of four zones - a doctor's room, an isolation room, a medical room/ward and a twin-bed ICU, maintained at negative pressure. Post-pandemic, these cabins can be remodelled into micro-hospitals/clinics for rural places."

- **SHREERAM RAVICHANDRAN**,
Chief Executive Officer, Modulus Housing, Chennai

providing coronavirus information through advanced technology. Apple and Google have also been working on a contact-tracing tool to help contain the spread of COVID-19. The two technology leaders have launched COVID-19 contact tracing platform called Exposure Notification API. This platform allows public health authorities to build COVID-19 contact tracing apps without violating user privacy.

Moving a step ahead, Microsoft India is funding two projects at the Indian Institute of Technology (IIT) in Delhi focused on COVID-19 detection. One of the projects pertains to the probe-free real-time PCR-based COVID-19 detection assay developed at the Krishna School of Biological Sciences, IIT Delhi.

The other project is a collaboration between IIT Delhi and National Chemical Laboratory, Pune, and aims to develop an ELISA based diagnostic serological assay against COVID-19. If successful, it will create an economical, commercial process for manufacturing the antigens used in ELISA and home-based diagnostic kits to offer an effective, quick, robust and affordable diagnostic solution to COVID-19 outbreak.

On this note, Rohini Srivathsa, National Technology Officer, Microsoft India, Bengaluru says, "We want to make sure researchers working to combat COVID-19 have access to the tools and resources they need. Researchers at IIT Delhi are leading a critical effort to develop low cost diagnostic solutions that will make COVID-19 testing much more affordable and accessible for all. Microsoft India is proud to support this effort and we hope that by expanding access to our technology resources and grants, we can help accelerate this important work."

Meanwhile, to test faster and predict patients



at risk for mitigating coronavirus transmission, the Silicon Valley based multinational technology company Intel has partnered with the Council of Scientific and Industrial Research (CSIR) and International Institute of Information Technology (IIIT), Hyderabad. As part of the initiative, Intel India is developing an end-to-end system that consists of multiple applications, testing devices, data collection and aggregation gateways, and an AI model-hub platform.

CSIR constituent labs will work with various hospitals and diagnostic chains in carrying out comprehensive diagnostics, and IIIT-Hyderabad will develop risk stratification algorithms that can help in drug and vaccine discovery for long term preparedness to combat the epidemic.

"Intel India is working with CSIR and IIIT-Hyderabad to rapidly develop and deploy solutions in the fight against COVID-19. Intel creates technologies that enrich lives and this initiative exemplifies our focus on deploying advanced technology to find effective and scalable solutions for urgent local needs. Technology has become cheaper, more accessible and far more efficient since SARS-CoV-1 hit us and remains crucial in this fight against SARS-CoV-2 as it



enables diagnostics, drug and vaccine discovery with higher predictability, speed and accuracy,” shares Nivruzi Rzi, Country Head, Intel India and Vice President, Data Platforms Group, Intel Corporation, Bengaluru.

Efforts by IITs- Masterminds of Technology

The Indian Institutes of Technology (IITs) continue to dominate the technology sector of our country for years by building experts in the digital transformation space. Out of the 23 institutes, IIT Madras, Delhi, Bombay, Kharagpur and Kharagpur are currently leading the way. It is thus not surprising that many of the global top tech companies are being run by IIT alumnus indicating that Indians are playing a key role in the success of technology powerhouses globally.

Besides making a mark in the global tech space for many decades, and playing an important role in the industry, the IITians at present are using their technology weapon to combat this pandemic. Over the last few months, a number of innovative solutions have been built by research teams at various IITs.

The most recent example is the launch of the world’s most affordable RT-PCR based COVID-19



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Director, IBM Research India & Chief Technology Officer, IBM India /South Asia, Bengaluru



“The most sophisticated computer-controlled ventilators cost around Rs 40 lakh while more modest foreign-made ones cost around Rs 15 lakh with Indian-made ventilators costing around Rs 6 lakh. We cannot depend on the conventional ventilators for a solution to this crisis.”

- **PROF. B.S. MURTY,**

Director, IIT Hyderabad



“We have identified unique regions i.e. short stretches of RNA sequences in the SARS-COV-2 genome. These regions are not present in other human corona viruses providing an opportunity to specifically detect COVID-19.”

- **PROF. JAMES GOMES,**

Kusuma School of Biological Sciences, IIT Delhi

TECH GIANTS PROVIDING COVID-19 SOLUTIONS

Company	Solution
Wipro 3D, Bengaluru	Emergency ventilator system
Larsen & Toubro, Mumbai	Technology management centres
Hexaware, Mumbai	Quarantine care software
Hewlett Packard Enterprise, US	Test labs & OPD centres
IBM, US	COVID-19 information tracker
Microsoft, US	COVID-19 information tracker, Funding IIT-D projects for COVID-19 diagnostic tests
Apple, US	COVID-19 information tracker
Google, US	COVID-19 information tracker
Intel, US	Multiple application platform



"While the existing N-95 mask does not protect the user if there is an imperfect seal between the mask and the face, as there is negative pressure inside the mask. In contrast, the Positive Pressure Respirator System (PPRS) provides uncontaminated air because it uses positive pressures."

- **PROF. NACHIKETA TIWARI**,
Associate Professor, Department of
Mechanical Engineering, IIT Kanpur



"With AI, the remote trolley can be deployed autonomously in the high-infection zone to deliver essential supplies. The features of the trolley include detection of obstruction and medical personnel's movement."

- **DR ROHIT SHARMA**,
Associate Professor, Department of
Electrical Engineering, IIT Ropar

diagnostic kit Corosure developed by IIT Delhi. The base price of the RT-PCR assay is Rs 399. Even after adding the RNA isolation and laboratory charges, the cost per test is considerably cheaper compared to currently available kits in the market. Another highlight of this product is that it is the first probe-free assay for COVID-19, approved by the Indian Council of Medical Research (ICMR).

"We have identified unique regions i.e. short stretches of RNA sequences in the SARS-COV-2 genome. These regions are not present in other human corona viruses providing an opportunity to specifically detect COVID-19. This method uses primers targeting unique regions of COVID-19 that were designed and tested using real time PCR. These primers specifically bind to regions conserved in over 400 fully sequenced COVID-19 genomes. This highly sensitive assay was developed by extensive optimization using synthetic DNA constructs followed by in vitro generated RNA fragments. This is the first probe-free assay for COVID-19 approved by ICMR and it will be useful for specific and affordable high throughput testing. This assay can be easily scaled up as it does not require fluorescent probes", says Prof. James Gomes, Kusuma School of Biological Sciences, IIT Delhi.

Addressing a similar concern related to the availability of low cost diagnostic tests for COVID-19, IIT Kharagpur researchers have innovated a novel portable rapid diagnostic device to detect COVID-19 infection. The equipment will cost about Rs 2,000 if a pilot facility is used and with a large-scale commercial facility, the price can be further reduced.

Another innovative solution has been developed by a startup Modulus Housing incubated at IIT Madras, in the form of a portable hospital unit that can be installed anywhere within two hours by four people.

"Called 'MediCAB,' it is a decentralized approach to detect, screen, identify, isolate and treat COVID-19 patients in their local communities through these portable microstructures. MediCAB has been

launched recently in Wayanad district of Kerala where the units are being deployed to treat COVID-19 patients. We are developing micro hospitals that can be deployed rapidly across the nation. The ModCAB is foldable and is composed of four zones – a doctor's room, an isolation room, a medical room/ward and a twin-bed ICU, maintained at negative pressure. Post-Pandemic, these cabins can be remodelled into micro-hospitals/clinics for rural places", shares Shreeram Ravichandran, Chief Executive Officer, Modulus Housing, Chennai.

Another startup at IIT Madras, Helyxon has developed and deployed a novel remote patient monitoring device for COVID-19. The device is a first-of-its-kind in the market that does clinically accurate continuous monitoring of four critical parameters – temperature, oxygen saturation, respiratory rate and heart rate. The cost of the device ranges from Rs 2,500 to 10,000 depending on the configuration and parameters.

Adding on, researchers at IIT Kanpur have built an alternative to N-95 masks in the form of a Positive Pressure Respirator System (PPRS), thereby addressing the problem of acute scarcity of N-95 respirator masks, which are a critical component of Personal Protection Equipment (PPE) kits.

"The PPRS is made up of a snug, comfortable and leak-proof transparent enclosure for mouth and nose which receive positive pressure air from a portable, light, and wearable air-bottle as well as a trolley-mounted large cylinder. While the existing N-95 mask does not protect the user if there is an imperfect seal between the mask and the face, as there is negative pressure inside the mask. In contrast, the PPRS provides uncontaminated air because it uses positive pressures. Thus, contaminated air from the room cannot enter the PPRS even in presence of leakages", says Prof. Nachiketa Tiwari, Associate Professor, Department of Mechanical Engineering, IIT Kanpur.

IIT Hyderabad has come up with an alternative to meet the surge in demand for ventilators at this critical hour. The institute is recommending the use of small devices called bag valve masks to deliver breathing support in emergency situations as they are inexpensive, easy to produce, and portable.

"While bag valve mask is currently hand-powered and therefore not suitable for continuous use as a ventilator, it would be easy to design a similar device powered by an electrical source. Our estimate of the cost is that it can be manufactured for less than Rs 5000, or one-hundredth the cost of a conventional machine. The most sophisticated computer-controlled ventilators cost around Rs 40 lakh while more modest foreign-made ones cost around Rs 15 lakh with Indian-made ventilators costing around



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Rs 6 lakh. We cannot depend on the conventional ventilators for a solution to this crisis", points out Prof. B.S. Murty, Director, IIT Hyderabad.

In sync with this observation, IIT Mandi researchers have developed two low-cost portable ventilators. The developed prototypes are easy to use and can be taken to remote locations in case of a medical emergency.

"We have developed a Wi-Fi operated smart ventilator costing only Rs 4,000. The developed prototype is a mechanised Artificial Manual Breathing Unit (AMBU) bag with options to control breath rate and volume of air going into the patient's lungs. The unique feature of the developed product is, apart from manual operation, it can be controlled by a mobile application over Wi-Fi as well", mentions Dr Arpan Gupta, Associate Professor, School of Engineering, IIT Mandi.

The other ventilator developed by IIT Mandi is a mechanical ventilator that uses a low-cost self-inflating bag operated by an electric motor, and is priced under Rs 25,000.

Adding another touch of novelty to fight this crisis, IIT Mandi has developed an ultraviolet-C (UV-C) light based portable disinfection box and a foot-operated hand sanitiser dispenser. Priced at Rs 35,000, the disinfection box shows 99 per cent efficacy to kill bacteria such as *Escherichia coli* and *Staphylococcus aureus* within 40 seconds of UV-C light exposure. On the other hand, innovative hand sanitiser costs less than Rs 1,400 and has been installed in the various parts of the IIT Mandi campus.

Making full use of technology, IIT Kharagpur's Autonomous Ground Vehicle (AGV) research group under the Centre of Excellence for Robotics Research has developed a low-cost AI based cyber-physical system for monitoring social distance in public places. The device can visually detect the gap between individuals and play a proximity alert sound through audio output, for any violation of the social distancing norms.

A team at IIT Roorkee has also utilized AI to

devise a low cost software for COVID-19 detection. In collaboration with the Kyoto University in Japan, the researchers have developed a software package called INJA-AI, a rapid, non-invasive, medical-driven prediction module that can overcome the limitations in the current model of testing COVID-19. Furthermore, it can also enable testing in remote regions, as it does not rely on internet connectivity.

On a similar line, IIT Gandhinagar has developed an AI based deep learning tool for detection of COVID-19 from chest X-ray images. This online tool indicates the probability if a person is infected with the disease, which can be used for quick preliminary diagnosis before the medical test.

IIT Ropar has collaborated with Post Graduate Institute of Medical Education and Research (PGIMER) in Chandigarh and invented two low-cost devices, Medi-Sarathi and AI-powered trolley, to minimise healthcare workers' contact with infected COVID-19 patients and contaminated surroundings.

Explaining more about these products, Dr Rohit Sharma, Associate Professor, Department of Electrical Engineering, IIT Ropar says, "Medi Sarathi is equipped with complete remote access, thermal RGB cameras for human body temperature and sanitisation capability.

With AI, the remote trolley can be deployed autonomously in the high-infection zone to deliver essential supplies. The features of the trolley include detection of obstruction and medical personnel's movement."

Moving a step ahead, IIT Guwahati has developed robots that can be deployed in isolation wards for COVID-19 infected cases for delivery of food and medicine to patients and the collection of contagious waste, in order to reduce human intervention. The institute also plans to make robot-based screening units.

"Our idea is to make a state-of-the-art facility for the entire Northeast region in the form of an advanced research centre and laboratory for COVID-19 analysis. This centre in the future would help to develop highly competent manpower for diagnosis of different infectious diseases in the early stage of infection and thus its prevention too," mentions Prof. TG Sitharam, Director, IIT Guwahati.

At present, every ounce of technological innovation and ingenuity brought out to fight this pandemic brings us one step closer to overcoming it. Technology adoption is indeed playing a key role in better understanding and addressing the COVID-19 crisis with the right amount of fuel being added by the tech giants. ■

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