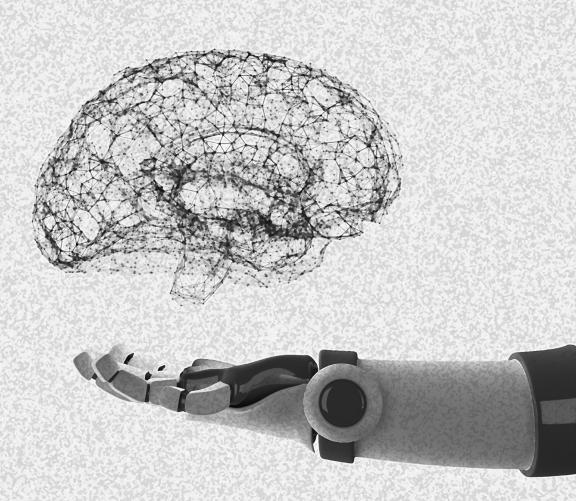


Deep tech in Healthcare



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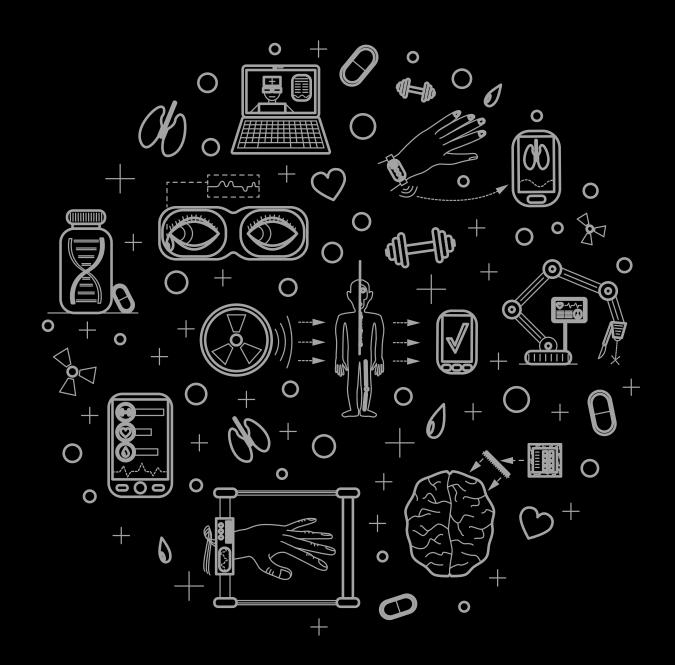
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Introduction

In this report, we propose a framework to define the term 'deep tech'. Using this framework, we scanned a sample set of 750+ healthtech startups in India with an intent to identify those that are developing deep tech solutions. We were able to shortlist 42 deep tech startups.

Through select case studies, we showcase how these startups are pushing boundaries of innovation. We outline crucial aspects of product development, funding trends, and the challenges faced by deep tech startups in India.

Finally, we also assess the policy landscape and suggest mechanisms for effective implementation of recent policy initiatives. Deep tech leverages power of new age technologies to solve for some of the most complex healthcare challenges, at unprecedented scale. Many of these are unaddressable by existing interventions and solutions.

Health impact of climate change



- Air pollution kills an estimated 7 million people every year
- Between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year
- The direct cost of impact on health due to climate change is estimated to be USD 2-4 billion per year by 2030

Tackling diseases



- Infectious diseases caused an estimated 4 million deaths in 2020
- Vaccine-preventable diseases e.g. measles, caused 140,000 deaths in 2019

Anti-microbial resistance (AMR)



- Antibiotic resistance leads to longer hospital stays, higher medical costs and increased mortality
- In 2019, AMR caused more than 6 million deaths globally. This could increase to 10 million by 2050 (on par with cancer)
- Annual economic impact of USD 3.4 trillion on global GDP

Shortage of healthcare workers



- Estimated shortage of 10 million healthcare workers globally by 2030
- Compromises all efforts to provide extensive healthcare delivery
- Low-and-Middle-Income Countries(LMICs) are disproportionately impacted (6.5 times more health workers per population in high income countries than LMICs)

Health inequity



- In 2019, gap of 18 years reported in average life expectancy between low- and high-income countries
- Survival rates due to cancer in children reported to be above 80 percent in high-income countries, as compared with 30 percent in LMICs

Defining deep tech

There is a need to have a clear definition of deep tech to support the growth of the ecosystem

There is a significant difference in interpretation amongst startup ecosystem players about what is deep tech.

Some common themes in defining deep tech include:

Research & Innovation

Deep tech products involve path-breaking research, which often has a long gestation periods.

Impact

Deep tech products can potentially create radical impact by offering new solutions or considerably improving efficiency and productivity.

IP Oriented

IPs owned by deep tech startups are strong defensible moats.

We propose below characteristics to consider an intervention as deep tech.

"It is a breakthrough technology which may combine 2 or more advanced technologies* to provide innovative, transformative, first-in-market solutions"

Key characteristics of deep tech:

- R&D intensive & IP driven
- Introduces radically new capabilities
- Has potential to be commercialized

*An indicative (non-exhaustive) list of advance technologies
Artificial Intelligence | Blockchain | Quantum Computing |
Nanotechnology | Biotechnology | Extended Reality | Robotics |
3D – Printing | Photonics and Electronics | Advanced Materials



Developer of novel antibiotics and immuno-oncology therapies Founded – 2014; Location – Bengaluru Company stage – Series B; Total funding – USD 36.1 Mn

Case Study

R&D Intensive & IP driven

- Bugworks is a clinical-stage biopharma company working to develop novel antibiotics and immuno-oncology (IO) drugs. Established in 2014, the company expects filing for marketing authorization only in 2028/2029.
- Bugworks has filed 45 patent applications globally. Till date, 17 patents have been granted across India, US, EU, SA, China and Japan.

Introduces radically new capabilities

- Its antibiotic drug candidate, if successful, will be the first oral, broad-spectrum antibiotic since 1987. It thus, offers to address an unmet market need.
- Similarly, the novel, small molecule IO drug candidate offers potential to be administered in oral solid dosage form. This offers significant advantages in reducing cost of therapy and improving treatment compliance as compared to existing biologic therapies.

Has potential to be commercialized

- The antibiotic drug candidate is being evaluated for infections from head to toe chest, stomach, bladder, blood, sexually transmitted disease and community infections. There is market potential of \$1billion/year across indications.
- The small molecule IO drug has sales potential of \$3-5 billion/year across a variety of hard-to-treat cancers.



Proprietary platform for development of anti-metastatic drug candidates Founded – 2018; Location – Bengaluru Company stage – Seed; Total funding – USD 220K

Case Study

R&D Intensive & IP driven

- The company invested 3 years from 2019 to 2022 to develop in-house platform technologies that mimic human cancer metastasis biology. It thus enables testing potential anti-metastatic drug candidates.
- The company has filed for 2 international patents.

Introduces radically new capabilities

- METAssay™ provides multiple in vitro phenotypic assays capable of differentiating between growing and moving tumor cells belonging to the same tumor.
- METVivo[™] a highly efficient metastasis animal model platform that allows creation of orthotopic models in 6 weeks as compared to 4-6 months taken conventionally.
- METSCAN™ a unique platform that integrates data generated from the METAssay™. Machine learning models are then applied to determine the probability of metastasis for the patient.

Has potential to be commercialized

- The platform technologies offer immense commercialization potential in novel drug development as well as companion diagnostics.
- The company is actively working with leading industry and academia players to further leverage the platforms' potential to identify novel anti-metastatic drug candidates.



Mechanical CPAP solutions for neonates with respiratory distress syndrome Founded – 2014; Location – Bengaluru Company stage – Seed; Total funding – USD 657,000

Case Study

R&D Intensive & IP driven

- Innaccel developed a resource independent ventilator for the neonates (SAANS) and an automated oral hygiene management device for patients on ventilator (VAPCare). It took them 4 years of intensive R&D to ideate, develop and launch these product in the market.
- The company has multiple registered patents for these products in India, Japan, Europe, South Africa, USA, and Brazil.

Introduces radically new capabilities

- Due to its non-invasive and resource independence features, SAANS improves caregivers' ability to provide ventilator support in remote areas or during transit to the hospital.
- VAPCare minimizes manual oral hygiene interventions for ventilated patients, reducing nurse dependency.

Has potential to be commercialized

- SAANS offers immense market potential in countries which do not have good primary healthcare facilities.
- VAPCare was commercialized in late 2020 and it played a significant role for the hospitals to combat the COVID-19 pandemic.

Startups' profile

From 750+ healthtechs, we identified 42 deep tech startups*. These startups are building products in four main categories.

Diagnostics (N=16)

- Hand held/ point-of-care devices to aid in disease screening and diagnosis
- Non-invasive solutions for TB diagnosis
- Radiological image analysis
- Predictive image analysis

Medical Devices (N=11)

- Assistive robots for surgical use
- Robotic exoskeletons / prosthetics for mobility and rehabilitation
- Artificial intraocular implants
- Brain-computer interface for health and wellness

Therapeutics (N=10)

- First-in-class therapeutics
- Omics-based, in-silico platforms leveraging AI/ML to expedite drug discovery
- Drugs for antibiotic –resistant bacterial infections

Others (N=5)

- Al based patient monitoring systems
- 3D bio-printing for tissue engineering
- Protein-based tissue regeneration products















ZUMUTOR

bugworks

CARLBIO









^{* -} Indicative analysis; not exhaustive

The combination of real-world healthcare data and artificial intelligence is creating new possibilities in medical innovation

- Much of the novel deep tech applications in healthcare have been possible owing to the ability of AI:
 - To process complex data to recognize patterns and generate personalized insights thereby facilitating real time decision making
 - Feed into or work alongside other advanced technologies to generate exponential outcomes
- Close to 60% of the deep tech startups use artificial intelligence (standalone or in combination with other technologies) as their tech backbone































Surgical Robots



Prosthetics & Exoskeletons



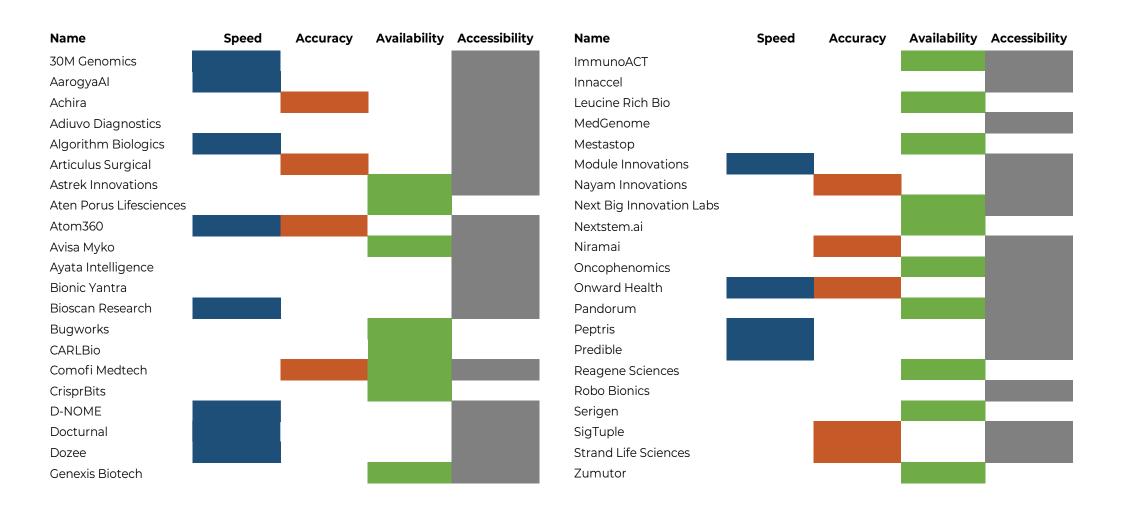
Remote Monitoring



Drug Discovery

Varied applications of AI to build deep tech solutions

Deep tech startups in healthcare are solving for speed, accuracy, availability and accessibility



d-nome



Problem Statement

RT-PCR and genome sequencing are valuable tools for precise clinical diagnostics, but diagnostic labs struggle to scale up due to high costs and time delays. Complex protocols, expensive reagents, and skilled technicians are limitations to these technique and poses a hindrance for wider implementation.

Accessibility & Speed

D-NOME technology is improving accessibility as D Lamp technology can be used at point-of-care owing to its ability to be stable at ambient temperature setting. It reduces the operational cost of diagnostic labs by 10x and delivers 5x faster results.

Problem Statement

Tuberculosis is one of the prominent causes of mortality worldwide. Existing screening methods involve sputum test, which requires the patient to provide a sample of their phlegm. This is then tested in a lab. The existing testing process hinders accessibility, is time consuming and increases cost.

Accessibility & Speed

Docturnal Pvt. Ltd. provides point-of-care, non-invasive and real-time screening solutions for tuberculosis. Their product TimBre is available as a smartphone application and uses cough sounds as a biomarker to detect tuberculosis. It is reported to work with 85% accuracy, reduces turnaround time and can help overcome challenges to on-ground access to TB testing facilities.





Problem Statement

Cancer is the second leading cause of death worldwide with solid tumors accounting for 90% of cancer cases globally.

Immunotherapy, which is being increasingly adopted in the treatment of cancer, currently has rather limited uptake in case of solid tumors. This is due to evolving nature of our understanding of immune suppressive tumor microenvironments.

Availability

Scientific research has established the role of LLT1-CD161 interaction to modulate immune response (NK cells) against solid tumors.

Zumutor's lead drug candidate ZM008, is a first-in-class anti-LLT1 monoclonal antibody with demonstrated clinical potential for multiple solid cancers. This helps to overcome immunosuppressive nature of tumor microenvironment.

Problem Statement

Conventional surgical methods face challenges of complications due to blood loss especially in difficult procedures, high operative times etc. Hospitals are now increasing adoption of robot-assisted surgical systems to address these challenges.

Accessibility & Accuracy

The Articulus Pulsar surgical robotics system offers superior dexterity and precision to significantly improve accuracy. They also endeavor to provide the surgical robot system to hospitals at 25% capital cost, thereby making it more accessible.

Deep tech startups in healthcare require patient capital to demonstrate proof-of-concept / build product prototype

On an average, it took medical device and diagnostics deep tech startups **more than 2 years** to develop proof – of – concept or product prototype. This period can be **more than 5 years** for biopharma deep tech interventions.

Some of the reasons attributed for such long gestation periods include:

Long development cycle of research: Since the deep tech startups are working on highly innovative products, significantly high effort is invested in early research and development. Startups also require access to highly equipped lab setup to expedite product development.

No reference point: There is no prior product in the market that can be used as a reference point for developing the product.

Product Validation: Since most startups are building B2B solutions, doctors, hospitals, distributors, and pharmaceutical companies form an essential part of their product validation cycle. This often takes long.

Stakeholders	Why?	When?
Doctors	To identify and validate unmet need	Ideation and prototype development stage May continue until commercialization stage
Distributors or Pharma companies	To develop the product – market fit	Prototype until product commercialization Usually starts during the last phase of product development

Funding scenario

Diagnostics is the most preferred area for deep tech investments in the healthcare sector



- Between 2013-2023, the 42 deep tech startups covered in this study raised a total funding of USD 457 Mn. More than 75% of this funding has come from 2018 onwards.
- Diagnostics sector received ~80% of the funding between 2013-2023. It was also the only category to receive growth stage funding.
- More than 50% of the deep tech startups in healthcare are in early stages of their growth.

Several early stage and venture capital funds and government agencies have infused capital into deep tech startups in healthcare

Investors















GOVERNMENT OF INDIA MINISTRY OF MICRO, SMALL AND MEDIUM ENTERPRISES



इलेक्ट्रॉनिकी एवं सूचना प्रौद्योगिकी मंत्रालय

ELECTRONICS AND

INFORMATION TECHNOLOGY

MINISTRY OF

Government Grants



DEPARTMENT OF SCIENCE & TECHNOLOGY











































Challenges

Funding schemes need to be tailored according to unique growth requirements of deep tech startups

Access to finance

The funding requirements of deep tech startups are very different from those of other startups. There is a need for funding ecosystem to be aligned with specific needs of deep tech startups.

Existing government grant mechanisms pose a few challenges

- Smaller cheque size: Existing grant amounts are not enough for deep tech startups for their product development and validation, especially if the startup is developing hardware solution.
- **Tranche-based mechanism**: Existing tranche based mechanism adopts one-size-fit-all approach. It does not take into account that money required to reach key product development milestones varies as per the nature of product / service being built. This slows product development timelines.
- Slow transfer of grant money: Startups share that it usually takes 5-6 months from applying to the grant to receiving the grant money.

Challenges faced in fundraising with VCs

- Tech-Knowledge Gap: Investors' limited technical know-how hinders/delays the investment cycle.
- Product Novelty: Investors don't have any reference point to evaluate businesses proposals owing to novelty of the product.
- **High risk investment:** Large capital requirement and high failure rates makes investments in deep tech startups a very risky proposition for investors. This often delays decision making by investors.
- Lack of confidence: General lack of confidence that Indian innovators can develop breakthrough solutions to global challenges and that scientists can run companies.

Founders need business mentorship to help envision IP-to-market route and build high performing teams

Need to develop greater business acumen amongst deep tech startup founders

Founding team should include members with business / marketing skills to complement the tech proposition

- Deep tech startup founders conventionally come from science/research/tech backgrounds.
- They have strong understanding of breakthrough healthcare technology that has demonstrated success at lab-level.
- However, founders face challenges in developing a business case and envisioning lab-to-market pathway.
- Deep tech founders often fail to present a business case to investors while fundraising.

Access to skilled talent

Deep tech startups spend considerable amount of time and resources on employee training

- Deep tech startups rely heavily on their tech proposition. However, as business matures they need to build high performing teams that can build a scalable business around the pathbreaking tech.
- Startup founders often face challenge in hiring team members who understand the tech and business.

Policy initiatives

National Deep Tech Startup Policy: A comprehensive framework to address challenges faced by deep tech startups

On July 31, 2023, GOI released the draft **National Deep Tech Startup Policy**. Some of the proposed policy interventions that endeavor to address existing challenges in the deep tech ecosystem are as below:

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Access to finance

- Smaller cheque size of existing grant mechanism
- Long gestation period
- One size fits all approach
- Slow transfer of grant money

Key Interventions in Draft Policy

- Capital Guidance Fund Fund of Fund (FoF) mechanism involving government and private investors. Entails anchor commitment with patient deployment timelines of > 10 years
- Common grant framework across ministries INR 2 Cr to support proof-ofconcept and INR 3 Cr to support prototype testing
- Debt fund to meet working capital requirements of startups
- Single window platform to improve transparency in government grant disbursal lifecycle
- Recommended amendments to CSR rules to tap CSR funds for patient capital for deep tech startups

Tech knowledge gap to effectively assess investment proposals

 Proposed incorporation of committee comprising technical experts from industry, academia, government entities and higher educational institutions to enable fair assessment of technical viability of deep tech startups

Encouraging investor readiness

- First right of refusal to LPs/ VCs in proposed Capital Guidance Fund
- Fiscal incentives such as tax rebates to be explored to attract private investors upon allocation of certain percentage of corpus to deep tech startups
- Need to develop greater business acumen in startup founders
- Access to skilled manpower and building high performing teams

- Mentorship and experiential opportunities
- Skill enhancement grants to cover employee training and upskilling costs

Suggested interventions on policy initiatives

Remarks on National Deep Tech Startup Policy (1/2)

Defining deep tech

To enable growth of deep tech ecosystem in the country, it is critical to have standard guidelines or frameworks to screen deep tech startups. The absence of such standard frameworks will result in incorrect assessment of eligible deep tech startups that can benefit from policy initiatives.

2 Capital Guidance Fund (CGF)

- The CGF mechanism proposed in the National Deep Tech Startup Policy is an encouraging step.
- The government must take a strategic approach and identify priority sectors (healthcare, infrastructure, space, defense, telecommunications, mobility etc.) to support deep tech startups under this fund. This will help to achieve predetermined goals in line with national priorities.

Remarks on National Deep Tech Startup Policy (2/2)

3 CSR Funds

The National Deep Tech Startup Policy envisages re-assessment of existing CSR laws and make provisions to invest CSR funds to support deep tech startups as it will make it amenable for corporates to further support deep tech research and innovation.

Key role of incubators to support the growth of deep tech ecosystem in India

- In addition to customized funding schemes, deep tech startups in India also need support with other aspects.
 - Technology incubators assist with product development and testing, provide infrastructure support.
 - **Business incubators** assist startups with mentorship to develop business acumen, develop IP-to-market strategy, product testing and commercialization and a platform to network with ecosystem stakeholders including end buyers.
- The interventions envisaged under National Deep Tech Startup Policy can best be administered and driven by a network of select incubators across the country.
- Incubators are well suited to work alongside Government, VCs and corporates to scout potential deep tech startups for investments, manage government grant disbursements and CSR funds. They can help foster greater investor readiness through structured programmatic interventions.

Annexures

Deep tech startups in healthcare (1/2)



Developer of platform for personalized anticoagulant drug



Cloud and Al-enabled software for diagnosing drug-resistant tuberculosis



Provider of diagnostic medical devices for multiple therapeutic areas



Manufacturer of assay agnostic test kits



Developer of robotic systems for surgical procedures



Developer of a lower limb exoskeleton device for mobility assistance



Therapies for rare diseases using gene delivery technology



Provider of AI based surgical robots



Manufacturer of Al and IoT-based eyewear with bone conduction speakers



Alternative proteins for human needs with our approach of precision fermentation and cell culture based technology



Provider of robotic exoskeleton for mobility and rehabilitation



Developer of a Al-based intracranial haemorrhage screening device



Developer of drugs for antibiotic-resistant bacterial infections



In Silico proteomics services for drug discovery



Developer of AI and AR based assistive robots for surgery



Developer of CRISPR based diagnostic and surveillance tests



Developer of reagents and kits for molecular diagnostics



Offer an app for Al-based non-invasive solution for tuberculosis detection



Provider of Al-based patient monitoring system for healthcare providers



Developer of cell therapies for cancer treatment.

Deep tech startups in healthcare (2/2)



Developer of medical devices



Developer of genomic tests to provide personalized medicine for cancer



Provider of the genomics-based platform to analyze microbiome



Provider of predictive analytics platform by artificial intelligence



Provider of genomics-driven research and diagnostics platform



Provider of Al-based proteomic data analysis software for drug discovery



Developer of cell-based functional assays for drug discovery



Provider of AI-based radiological image analysis and diagnosis platform



Developer of diagnostics strip for rapid bacterial detection



Provider of prosthetic hand system for amputees



Developing an artificial implantable intraocular lens to treat cataracts



Developer of protein-based tissue regeneration products



Provider of 3D bioprinting technology for tissue engineering



Al based healthcare diagnostic solution



State of the art Brain Computer Interface with applications in health & wellness



Provider of omics-based solutions for clinical genomics, systems biology, and drug discovery



Developer of Al-based early-stage breast cancer screening devices



Developer of novel immuno therapeutics for the treatment of cancer



POC devices for use in low resource settings



Developer of regenerative medicine and 3D tissues



Manufacturer of water soluble and affordable melanin.



Provider of research reagents and kits

References

Data of individual organizations was sourced from their website and / or official social media handles of the company. Additional references are listed below.

Ani News. (2021, May 5). Mestastop Solutions: A biotechnology startup changing the fight against cancer metastasis. Retrieved from https://www.aninews.in/news/business/business/mestastop-solutions-a-biotechnology-startup-changing-the-fight-against-cancer-metastasis20210505161020/

BioVoiceNews. (n.d.). Our Lead Antibacterial Asset is Undergoing First-in-Human Phase I Clinical Trials. Retrieved from https://www.biovoicenews.com/our-lead-antibacterial-asset-is-undergoing-first-in-human-phase-i-clinical-trials/

Centre for Cellular and Molecular Platforms. (n.d.). Start-ups. Retrieved from https://www.ccamp.res.in/start-ups

Economic Times. Zumutor Biologics bags \$6.2 million funding led by Siana Capital. Retrieved from https://economictimes.india-times.com/tech/funding/zumutor-biologics-bags-6-2-million-funding-led-by-siana-capital/articleshow/88188476.cms

Fortune India. (n.d.). Pharma's R&D Ambitions Go Global. Retrieved from https://www.fortuneindia.com/long-reads/pharmas-rd-ambitions-go-global/112159/

Financial Express. InnAccel: The MedTech startup that is innovating to save lives. Retrieved from https://www.financialex-press.com/industry/sme/innaccel-the-medtech-startup-that-is-innovating-to-save-lives/1651781/

National Center for Biotechnology Information. (2017). [Title of the article]. PMC. Retrieved from https://www.ncbi.nlm.nih.gov/p-mc/articles/PMC5403050/

National Center for Biotechnology Information. (2018). [Title of the article]. PMC. Retrieved from https://www.ncbi.nlm.nih.gov/p-mc/articles/PMC6205949/

ResearchGate. The H-bug epidemic: The impact of antibiotic-resistant staphylococcal infection on New Zealand society and health, 1955-1963. Retrieved from https://www.researchgate.net/publication/30040222_The_H-bug_e-pidemic_the_impact_of_antibiotic-resistant_staphylococcal_infection_on_New_Zealand_society_and_health_1955-1963

Tracxn. Retrieved from https://www.tracxn.com

World Health Organization. Urgent health challenges for the next decade. Retrieved from https://www.who.int/news-room/photo-story/photo-story-detail/urgent-health-challenges-for-the-next-decade

Deep tech in Healthcare

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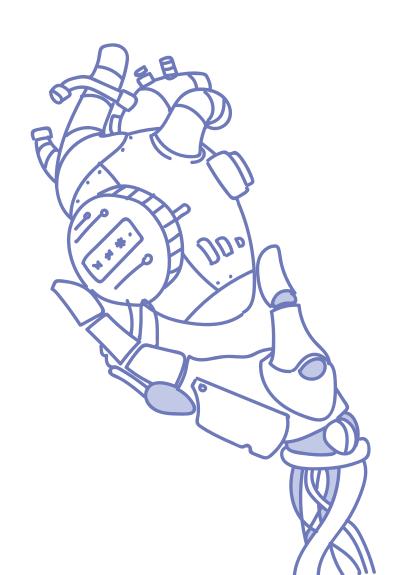
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ABOUT IIMA-CIIE

IIMA-CIIE is The Innovation Continuum at IIM Ahmedabad. Founded in 2002, IIMA-CIIE has grown and pivoted to address the multiple emergent gaps in India's innovation-driven entrepreneurship ecosystem. Today, this continuum spreads across incubation, acceleration, seed and growth funding, and research.

In its 15 year long journey, IIMA-CIIE has delivered several firsts in India's startup story. Among various initiatives, IIMA-CIIE published India's first entrepreneurship bestseller - Stay Hungry Stay Foolish; conceptualised and hosted India's first accelerator - iAccelerator; created India's first cleantech focused fund - INFUSE Ventures; designed and hosted one of India's largest accelerator programs - The Power of Ideas and ran it for over a decade; designed and ran a comprehensive platform initiative for inclusive fintechs - Bharat Inclusion Initiative; and, continues to host the first-of-its-kind on-campus entrepreneurship program for IIMA students - IIMAvericks. Overall, IIMA-CIIE has accelerated 1500+ startups, invested in 350+ startups, mentored and coached 5000+ founders and inspired over 1 million with publications like Stay Hungry Stay Foolish, Startup Compass, industry reports and startup toolkits.

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