

Nanyang Technological University back in 2016. A year later, the Singapore Economic Development Board invested \$18 million in partnership with the National University of Singapore and NAMIC (the National Additive Manufacturing Innovation Cluster) to open another centre for additive manufacturing to apply 3D-printing technology in the biomedical and healthcare fields. As a result, more and more world-leading companies are being attracted to Singapore by the exciting work being done in this field. In 2018, German chemical company Evonik announced that its interest in the potential biomedicine applications of additive manufacturing had convinced it to develop a high impact research and development hub in Singapore.

Singapore's National Additive Manufacturing Innovation Cluster has also spread its roots in another Asian tech powerhouse, Taiwan. In 2018, NAMIC joined hands with Taiwan's China Medical University Hospital (CMUH) and National Applied Research Laboratories to create Asia's first medical 3D printing industry team. The 3D Printing Medical Research Centre (3D MRC) at CMUH is the world's first institute to hold the entire chain from the development of fundamental research to clinical applications. The operating model of the 3D MRC is unique when compared to similar entities in Asian, European, and American countries.

Dr Yi-Wen Chen, Deputy Director of 3D MRC shares, "Singapore's National Additive Manufacturing Innovation Cluster falls in line with the Taiwanese government's 'Southbound Policy', which is aimed at enhancing cooperation and exchanges between Taiwan and 18 countries in Southeast Asia, South Asia and Australasia. Taiwan has also developed a 3D printing laboratory at Hsinchu Biomedical Park in order to promote Taiwanese biotech and medical equipment on the global market."

Besides Taiwanese government, another layer is being added by the government in South Korea in the field of 3D printing. The Ministry of Science, ICT and Future Planning (MSIP) is spending much of the budget on various 3D printing businesses to strengthen South Korea's competitiveness and ability to meet the growing demands. The South Korean government has invested around \$37 million to accelerate the development of 3D printing across the country. The government is also exploring fast-track approvals for 3D printed medical devices in order to have the innovative devices available to patients as quickly as possible.

At par with others, Japan has invested \$22 million

Challenges



Technology Limitation

"There is a need for greater education and exposure to 3D printing technologies to address concerns around quality, reliability and consistency. In addition, there is also a need to expand the range of 3D printed materials available. Manufacturers need a wider choice of materials and they have to be able to manufacture products made of multiple materials"

- **Rob Mesaros**, Vice President of 3D Printing & Digital Manufacturing for Asia Pacific & Japan, HP Inc.



Lack of Regulatory Framework

"For 3D printing to drive widespread impact across the healthcare system, there is a need for significant ecosystem development. Foremost of the changes needed is a renewed regulatory framework that addresses development pathway for more complex Class II and Class III devices. For e.g. an orthopedic implant can be 3-D printed but current development process entails rigorous efforts around development and validation of the standardized design to obtain regulatory approval (often including simulated validation for 22-25 years of wear and tear), an approach hard to replicate in the case of customized 3D printed implants. Hence, there is a strong need for stakeholder convergence to envision how we leverage the power of 3D printing and possibility of customization or rapid turnaround without compromising on patient safety, a key element mandating rigor of validation currently required".

- **Pushpa Vijayaraghavan**, Director at Sathguru Management Consultants - Business and innovation advisory in Healthcare, Lifesciences



Need for collaboration

"The most empowering solutions come packed with equally strengthened challenges. Collaborative work in this domain could enable the innovators from different disciplines to harness the cross-discipline information to make a revolutionary product that would address the multiple challenges involved, with respect to time constraints, interoperability issues, costs, clinical evidences, speed, etc."

- **Guruprasad**, Vice president and Healthcare practice head, Bosch India