BioSpectrum
the business of Bio & Health Sciences
ASIA EDITION

0

10 July 2019 | Analysis | By Dr Manbeena Chawla

3D printing, also known as additive manufacturing was first developed in 1983 when the father of 3D printing Chuck Hall manufactured the world's first-ever 3D printer and used it to print a tiny eye wash cup. Today, that cup has paved the way for a quiet revolution that is changing the healthcare industry in dramatic ways.

Since its introduction, 3D printing has been used in various areas in the medical field, for example building anatomical models, personalising medical devices and implants, aiding in precision medical interventions and the latest development, 3D bioprinting. The technology is expected to be worth no less than $3 billion by 2021 and looks set to disrupt the cost implications of several medical procedures.

"The growth of 3D printing in the healthcare and medical industry is accelerating. According to a report from market research firm International Data Corporation (IDC) released in 2019, healthcare providers are set to be the second largest industry that will spend on 3D printing this year, with a spending total of nearly $1.8 billion", mentions **Rob Mesaros, Vice President of 3D Printing & Digital Manufacturing for Asia Pacific & Japan, HP Inc.**

Rising demand for implants customizations during surgical procedures coupled with growing R&D investments is driving the healthcare 3D printing market growth. Currently, North America is the leading contributor to the global healthcare 3D printing market. The North American healthcare 3D printing market is projected to expand at a CAGR of 22.7 per cent during 2019-2024, leading to a global revenue of $901.2 million by 2024. However, the Asia-Pacific (APAC) region is anticipated to expand at the highest CAGR of 25.9 per cent between 2019 and 2024.

"As we are gearing towards industry 4.0 era, 3D printing is poised to transform the manufacturing process and how things are made. The advent of 3D printing opens up endless possibilities and unleashing a disruptive power in the global supply chain. For the Asia-Pacific region, China is the main driving force. The Chinese government is in support of the industry and multiple 3D printing action plans and fiscal support are in place. As a result, the use and spending of 3D printing have received a boost in the country with continuous interest and rising maturity," points out **Mun Chun Lim, market analyst for IDC Asia-Pacific's imaging, printing and document solutions research.**

The Ministry of Industry and Information Technology in China released a plan to develop China's 3D printing industry in 2015 and 2016. That mission, the National 3D Printing Industry Development Promotion Plan (2015-2016), establishes goals for innovation and commercialization of 3D printing. In 2017, institutions in China spent $1.1 billion on 3D printing thus paving the way for customized implants that can reduce both use of materials and the likelihood of body rejection. Last year, China opened its first 3D bioprinting centre at Zhongshan People's Hospital which will be used to study fields such as regenerative medicine and human tissue engineering.

On the other hand, Singapore invested $30 million to open one of the largest 3D printing centre at the 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 through its New Energy and Industrial Technology Development Organization (NEDO) to spur the growth of highly advanced 3D printing mechanisms for human tissue regeneration. On the manufacturing front, Japan has also caught the eye of US based high performance additive manufacturing (HPAM) and material science company Oxford Performance Materials (OPM) who has collaborated with Tokyo based advanced material supplier JSR Corporation in 2018 to launch medical & dental operations across Asia. To add to this, the Ministry of Health, Labour, and Welfare (MHLW) has announced that medical insurance will cover the cost of 3D printed models for surgeons to use when preparing for difficult and highly intricate operations.

Another important market player in the field of medical devices within Asia is India. In 2018, Indian 3D printing service bureau, think3D, opened a new 3D printing facility for medical device manufacturing with an investment of $6 million. The facility is located in the AP MedTech Zone, a manufacturing park for medical equipment in the Indian state of Andhra Pradesh. Following up this year, Andhra Pradesh Innovation Society (APIS) and Andhra Pradesh Economic Development Board (APEDB) signed a pact with the American multinational information technology company HP Inc to build a Centre of Excellence (CoE) to work on 3D printing technology. Taking another step in the direction of advanced technology, Foundation for Innovation and Research at Sastra: Technology Business Incubator (FIRST) has been established at SASTRA University in Tamil Nadu with support from the Indian Government's Department of Science and Technology.

"3D printing market is gradually evolving in India. Bioprinting is one area where India can make a mark in the global market. This field of bioprinting can prove to be a key enabler in precision and personalized medicine", says **Alok Medikepura Anil, Director & Co-Founder, Next Big Innovation Labs.**

Though 3D printing has numerous applications in a variety of industries, it is effectively growing in the healthcare and medical space. As a result, a number of startups are also exploring this area. The confluence of a range of such new technologies, such as 3D printing, machine learning, and artificial intelligence, promises to both transform treatments and cut the costs associated with them, moving the work of healthcare professionals towards a more proactive and predictive regime, earlier

detection of diseases, and personalised care. “The prospering demand to leverage 3D printing in the Healthcare and medical device domain has been intense to deliver on patient-specific products to the end users. Med tech companies are forging to engage with providers to impart innovative and customized medical devices and solutions. There is a significant impact of 3D printing in the machine learning space, which can enable dramatic reduction in time & effort spent by med tech organizations on creating complex models, thereby enabling optimum channelization of their resources”, points out **Guruprasad, Vice president and Healthcare practice head, Bosch India**

Challenges beyond technology

3D printing is poised to disrupt the healthcare industry but there are a number of challenges associated with it such as lack of expertise, materials cost, technology limitations etc. Although these are some of the main challenges associated with 3D printing on average, their order shifts with an industry's needs and maturity in additive manufacturing adoption. Nevertheless, industry experts point out key obstacles that need immediate attention for the field of 3D printing to prosper-

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