Medical

Additive Manufacturing Opportunities in 2018–23

3dpbm x SMARTECHMARKETS PUBLISHING

Taking the AM Pulse

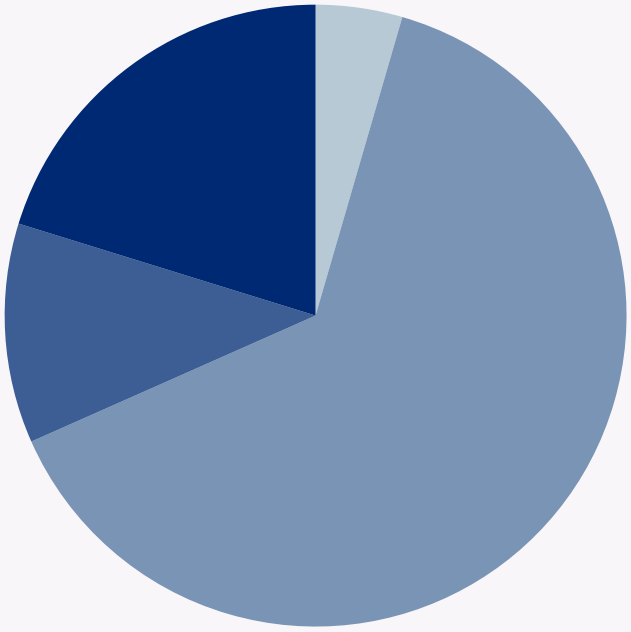
We continue to identify the application of 3D printing technology to medical treatments as one of the biggest technological innovations in healthcare over the next thirty years. In particular, SmarTech Publishing is active in quantifying medical 3D printing market opportunities in the shorter term, through the coming decade. During this period, 3DP is likely to see adoption for medical treatment purposes, and such applications are expected to drive a significant portion of the global 3DP market opportunity.

The total aggregated medical 3D printing opportunities are expected to reach **$4 billion in total by 2023**, growing from just over $1.5 billion at the end of 2018. SmarTech Publishing takes a market-based approach to creating forecasting and market data tracking models in 3D printing rather than attempting to model the entire cross-market industry size with a single approach. However, with a current market size of over $1.5 billion in total opportunities, medical related 3D printing is likely to account for nearly 15 percent of the total 3D printing industry today.

Additive manufacturing and 3D printing technologies of today are able to play a more direct role, with easier integration into medical care, than in any other industry adopting 3DP when looking across potential applications. Not only is the benefit of mass customization inherently more valuable in medical care than in consumer products or industrial uses, but the current print technologies and materials are more easily fit into the medical industry by way of high value applications that do not otherwise rely on robust parts that are required to have excellent mechanical properties over a long service life. 3D printing technologies have created huge value through the printing of surgical models, tools, guides, and similar parts by simply applying existing printers and materials.

Medical AM Market Share by Segment

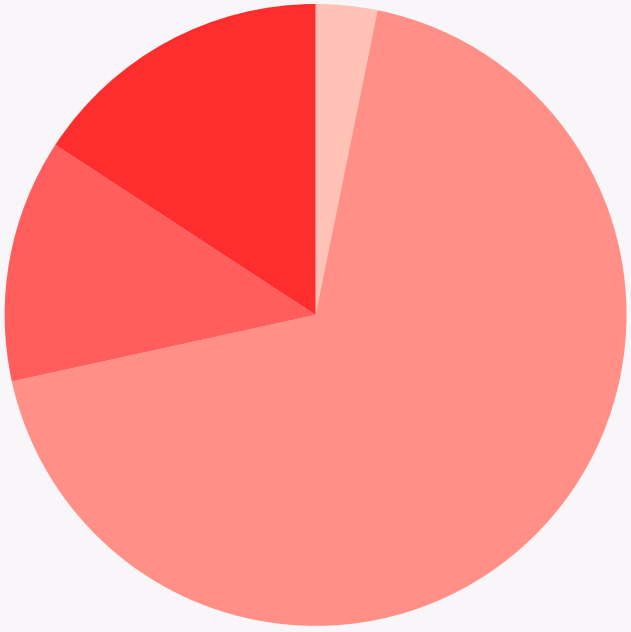
20% Hardware
11% Materials
64% Services
5% Software



2018

Source: Smartech Publishing

16% Hardware
13% Materials
68% Services
3% Software



2023

Source: Smartech Publishing

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Personalized implants

Additive manufacturing clearly holds significant potential value in the area of orthopedics, as evidenced by the major investments from both minor and major players in the orthopedic device market over the last five years. As a manufacturing process, additive manufacturing presents an opportunity to become a mainstay process for industry-standard implants which are already widely established—this area of production is relatively well established worldwide today, with continued strong growth potential to transition to additive production in major orthopedic areas.

The potential for personalization is particularly salient in the area of orthopedics, where every orthopedic procedure must take into account unique geometry of each patient's bone structure and related condition. As a result, processes which can enable the fabrication of suitable components direct from three dimensional data derived from medical imaging technology represent the 'holy grail' of medical manufacturing in orthopedics. For the foreseeable future, additive manufacturing is the premiere concept to achieve such a goal.

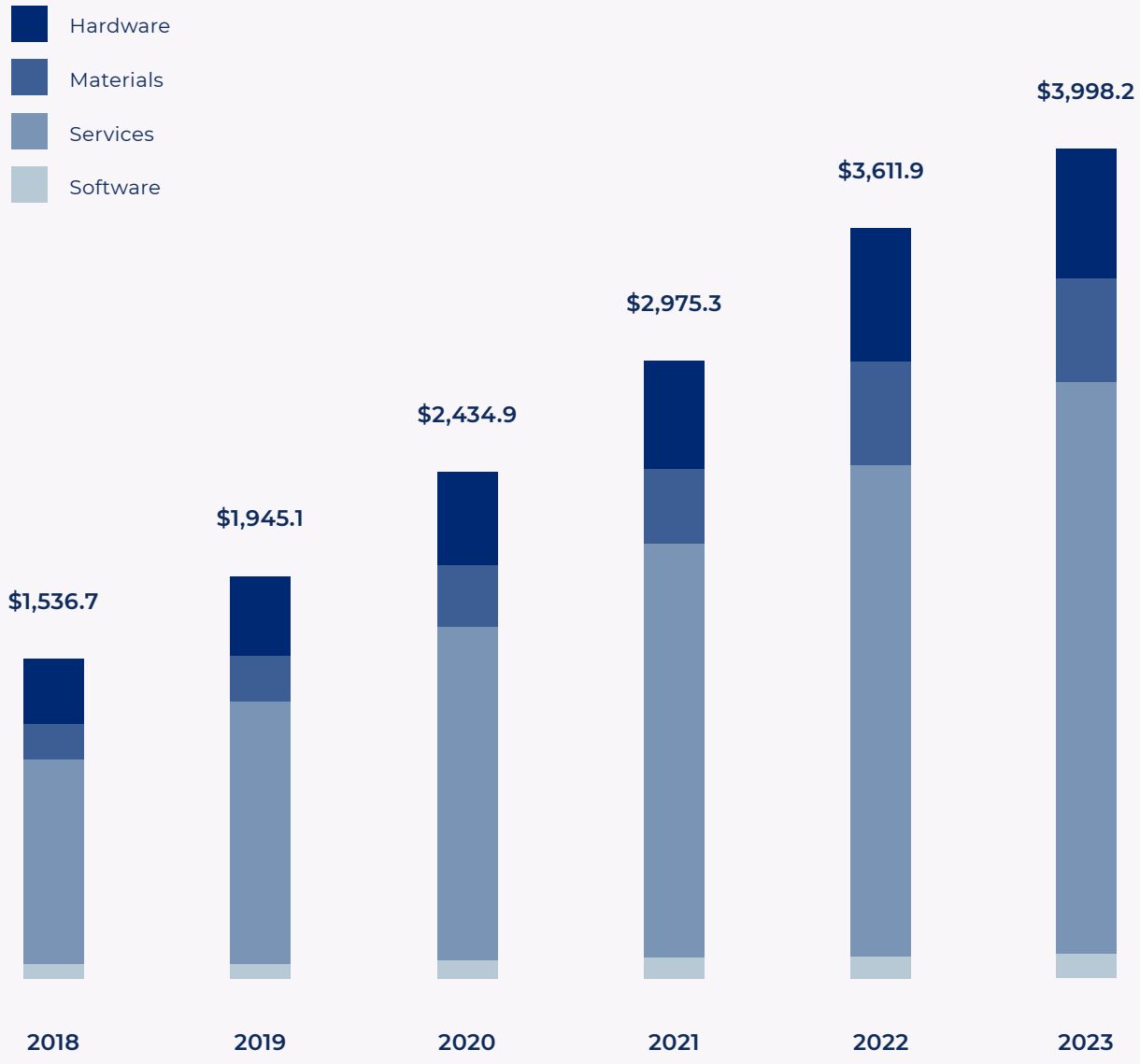
Personalized surgery

Looking at medical 3D printing (and excluding all dental-related opportunities) as a whole, the personal surgery segment is another attractive entry points for both healthcare providers looking to capitalize on technical innovation and especially for service providers in printing hoping to expand beyond rapid prototyping.

Personalized prosthetics

A number of exciting print technology innovations are also presenting improved opportunities for growth in medical 3D printing in the burgeoning

Total Projected Medical AM Revenue 2018-23 ($USM)



Source: Smartech Publishing

areas of orthotics, prosthetics, and audiology devices. Such innovations are having widespread impact on the overall 3D printing market by focusing primarily on transitioning classic rapid prototyping processes into manufacturing technologies by improving total throughput, cost per part, material availability, and mechanical performance of parts.

In the hearing aid segment, which relies entirely on photopolymerization 3D printing technologies, SmarTech Publishing believes that high-speed photopolymerization techniques now commercializing from **EnvisionTEC**, **Carbon**, **Carima**, **3D Systems**, and others will have numerous significant positive impacts to the economics of hearing aid shell production. There are several characteristics of high-speed photopolymerization techniques which will impact the hearing aid segment.

In the orthotic segment, the production of customized insoles using 3D printing is burgeoning, with powder bed fusion printing being the leading choice for production due to productivity and efficiency in printing geometrically complex lattice structures used to customize insole support characteristics.

The recently commercialized Multi Jet Fusion technology from **HP** Inc. is already targeting orthotic insole applications, while the thermal powder bed fusion approach using inkjet technology provides potentially significant cost-per-part benefits thanks primarily to a machine cost that is half to two-thirds less than most industrial laser sintering machines.

Finally, **Stratasys** continues to build out capabilities for its Robotic Composite concept technology using robot-enabled material extrusion for fiber reinforced thermoplastic composite printing. Though not commercialized, the potential for thermoplastic composite extrusion printing that can provide multi-axis capabilities thanks to advanced robotics presents some interesting possibilities in the areas of prosthetics and orthotics, where carbon fiber composites are becoming a staple for high end treatments. Though likely an industrial-level solution, such technologies may ultimately be comparable to robotic automated tape-laying systems for composite layup which are known to currently be employed by at least one global manufacturer of orthotic and prosthetic solutions today.

Full Report

See Report

As the medical 3D printing segment continues to evolve in ways which set it apart from the rest of the rapid prototyping and industrial additive manufacturing markets, interest in apply various technologies into the fabrication of medical devices has grown significantly. On the success of the orthopedic implants, surgical guide, and dental segments, now other medical practice areas have begun exploring digital manufacturing processes as a means to improve efficiency, and build a global supply chain to patients in need.

Prosthetic devices are the third major area of exploration for 3D printing technologies in medicine today, marked by two distinctly different medical treatment areas -audiology and the orthotics & prosthetics (O&P) markets. Such externally applied devices now being made with 3D printing technologies include hearing aids, upper and lower extremity prosthetics and componentry, and orthotic insoles and braces.

Where orthotic and prosthetic devices are just emerging as an area of interest and commercial opportunity with strong growth potential, the use of 3D printing in hearing aids has been long established. The outlook and market analysis in each area is therefore compared and contrasted, including an up-to-date outlook for continued growth opportunities for 3D printing in the hearing aid segment which has often incorrectly been written off as totally saturated.

SmarTech Publishing

A leading provider of industry analysis and market forecasts for the additive manufacturing industry. SmarTech Publishing's coverage provides insight to complement internal product planning and technology roadmapping, and provide low-cost knowledge enhancement for companies working in the AM industry.

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