3D PRINTING AND INCREASING ACCESS TO HEALTHCARE

TRENDS, TECHNOLOGIES, AND OUTLOOK

SMARTECH – WHO ARE WE?

About SmarTech Markets Publishing

- Specialized Industry Analysis – Additive Manufacturing is Our Foundation
- Purpose built industry market models and forecasting methodologies
- Solving the critical business development, strategic, and evolutionary challenges emerging from the industry today

SMARTECH - WHO DO WE SERVE?

80+ Clients Served

Industry Pioneers

Global Technology Leaders

Critical Suppliers

Users and Developers

How We Serve

Vertical Deep Dive Market Reports

- Automotive, Aerospace, Medical, and many more
- Exploring applications, strategies, supply chain analysis, adoption and penetration, etc.
- Valuation of opportunities by hardware, materials, software, and services

Critical Market Databases

- Global or regional unit sales by technology
- Install base data by technology
- Modeling of deep metrics – utilization, material costing, part volumes, technology die out, etc
- Historical and forecasted data

Customized Research Reports

- Client specific needs and parameters
- Insider interview database and insight collection
- Planning and strategy for specific products or business units

Ongoing Monthly Advisory Services

- Monthly reports and continually updated forecast data
- Covering markets by primary segmentations – metals, polymers, etc

AGENDA

- Why is AM/3DP such a powerful healthcare technology?
- Practical examination of how AM/3DP can be applied in healthcare
- Market acceptance and clinical acceptance factors
- Future trend outlook and presentation of critical healthcare AM/3DP market data

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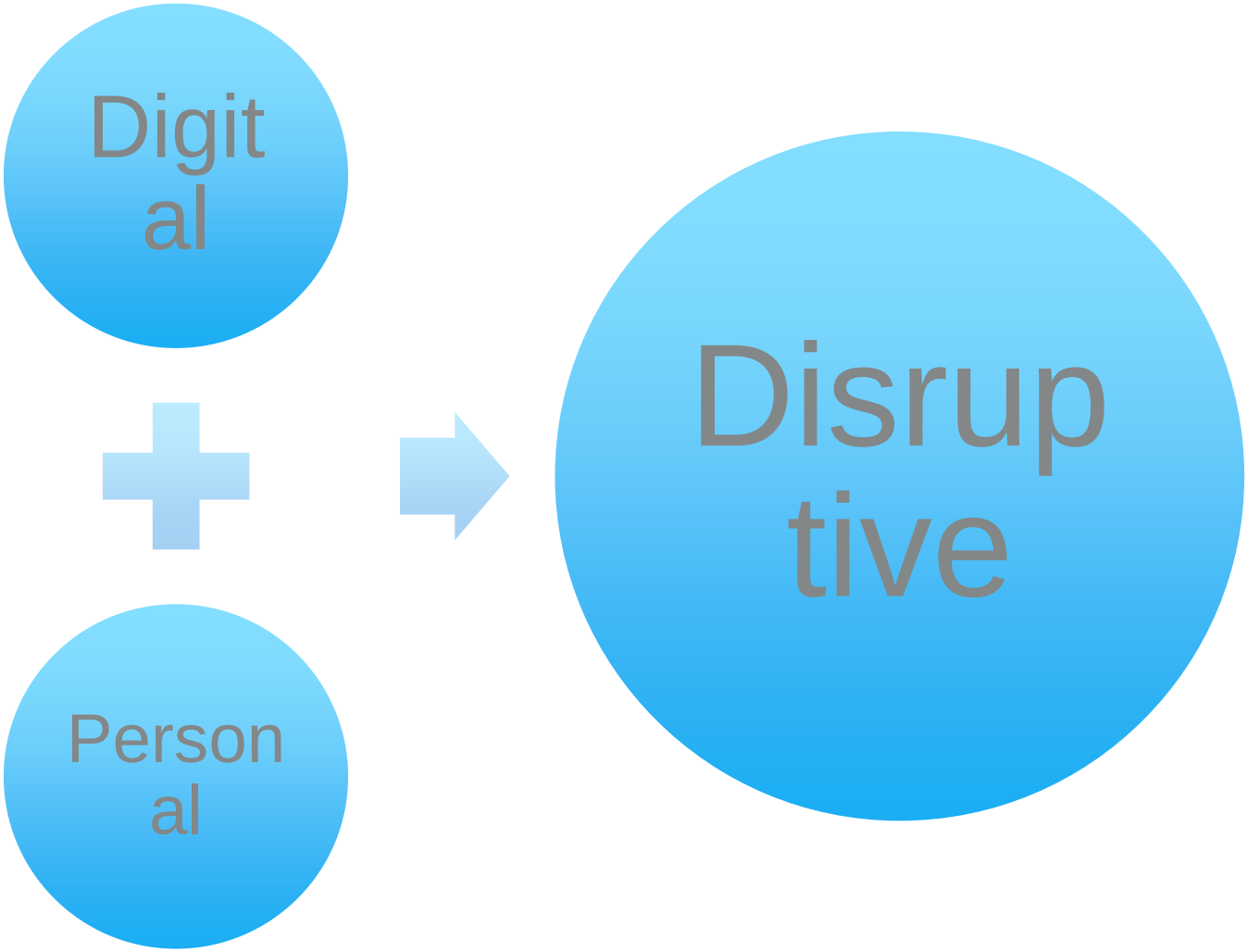
SECTION ONE

AM/3DP: A POWERFUL HEALTHCARE

WHAT MAKES AM/3DP TECHNOLOGIES POWERFUL FOR HEALTHCARE?



A TRUE SOLUTION FOR PERSONALIZED HEALTHCARE

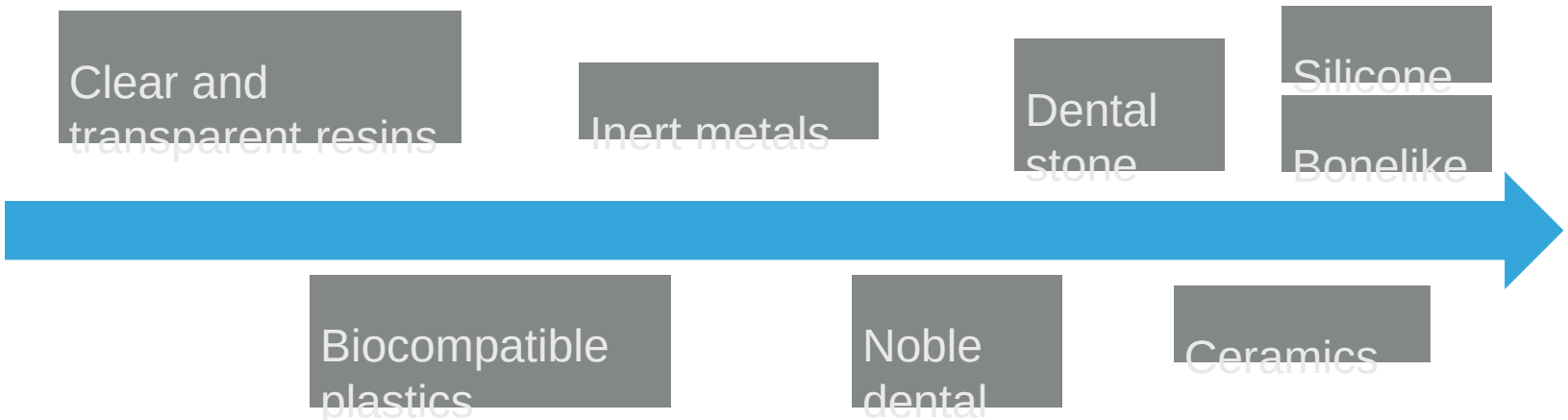
- Additive technologies are the only production solution to address personalized healthcare
  - A new design paradigm through distribution of mass
  - Multiple approaches to value in manufacturing
    - Custom shapes
    - Custom features

DIGITAL TECHNOLOGIES ENABLE HEALTHCARE EFFICIENCY

- 3D printers in the healthcare field are an enabling technology for medical synergy
  - Medical imaging
  - Measurement and data capture
  - Useful extensions of medical CAD packages

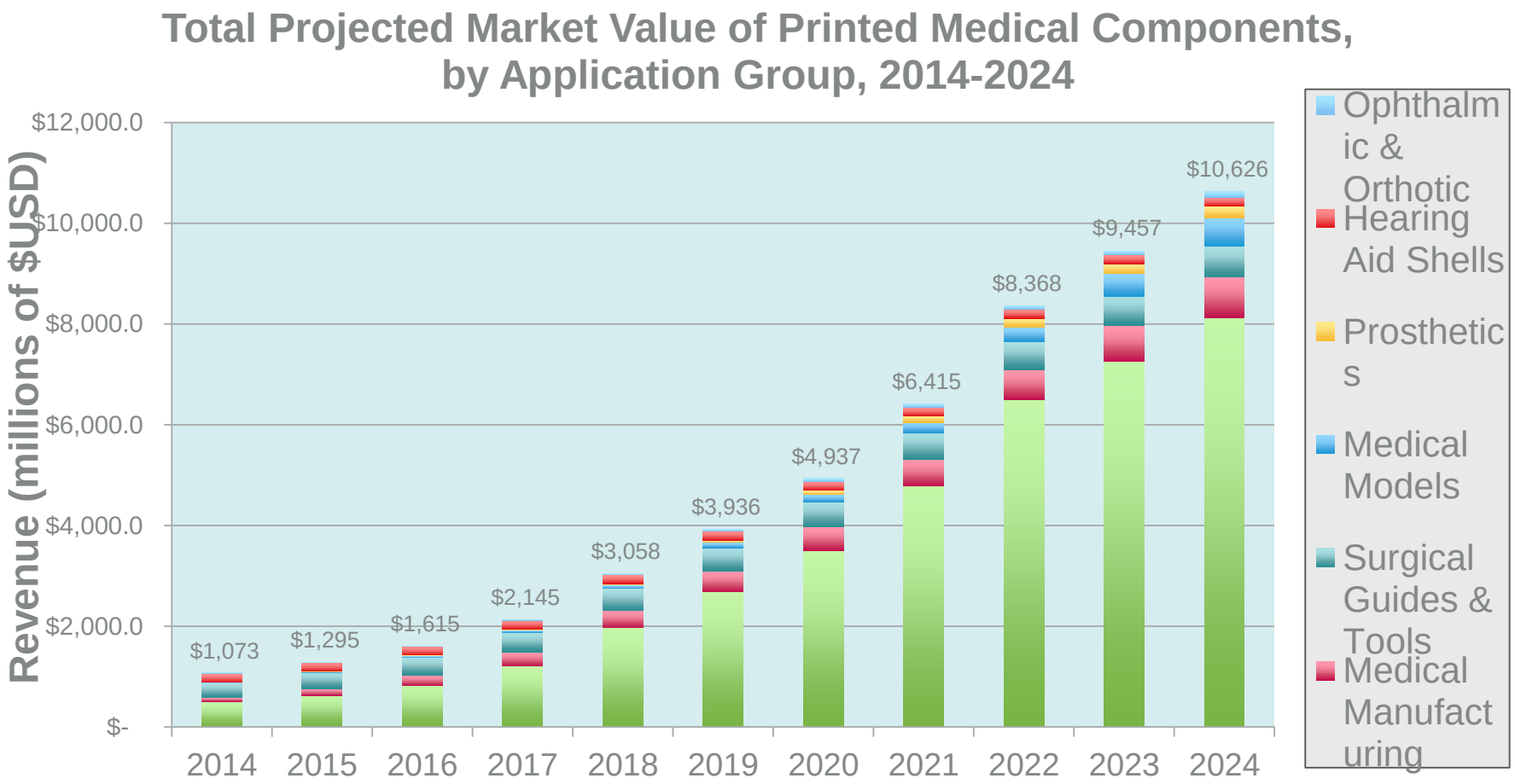
VOLUME, SCALABILITY, AND MATERIALS

- Components of the human body are well suited from a volume perspective for 3D printing capabilities
- Scalability in dentistry, surgical instruments, implants, and more
- The biggest sector of materials development for available systems are in medical and dental materials



WHAT DOES THIS TRANSLATE TO?

- Printed medical components are already generating over $1B in value annually



Source: *3D Printing in Medical Markets 2015,* SmarTech Publishing

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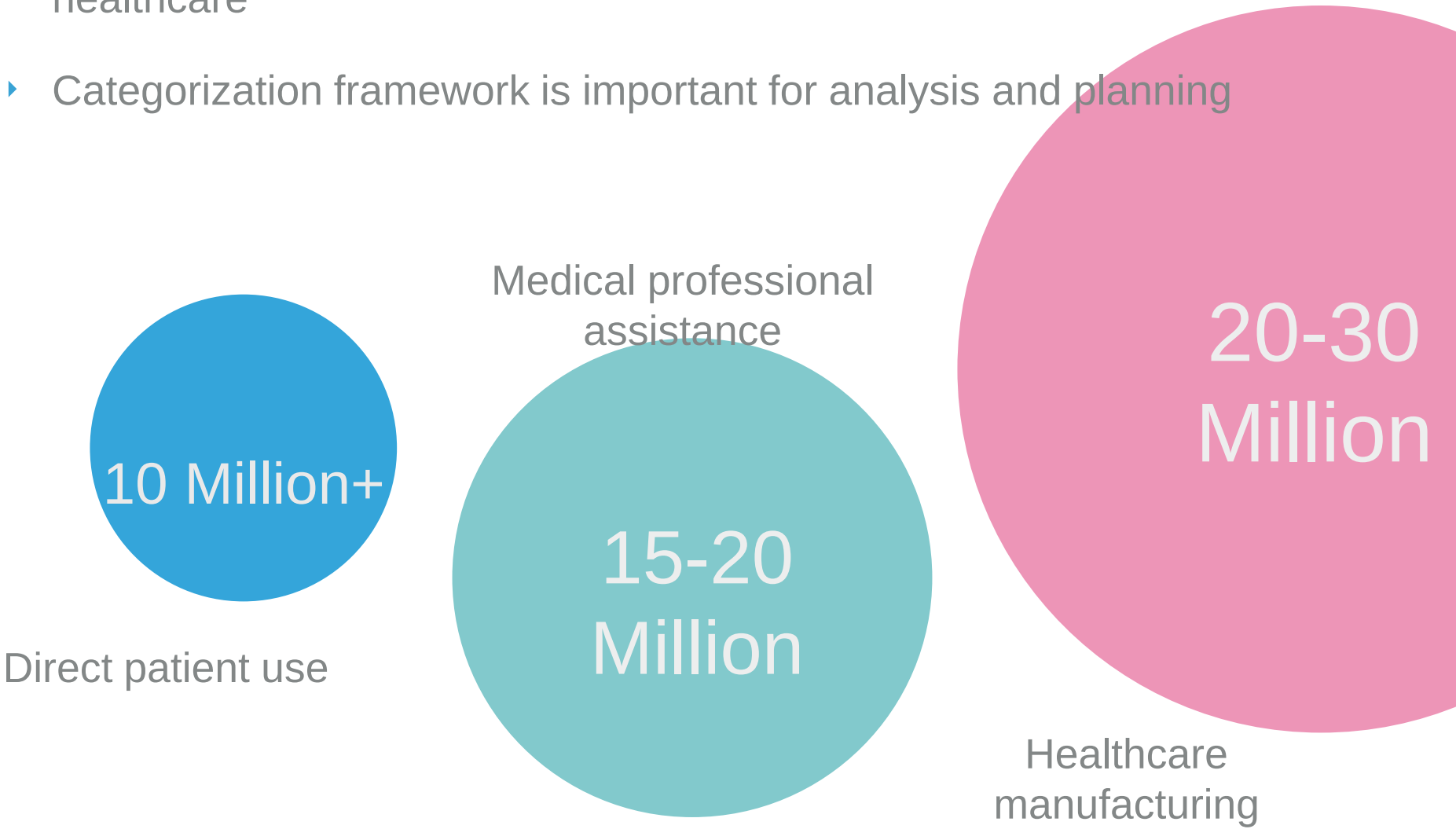
SECTION TWO

APPLICATION GUIDELINES FOR AM/3DP IN

HEALTHCARE IS THE MOST DISTRIBUTED USE OF AM/3DP

- Dozens of potential applications are emerging to build onto a significant number of well established and rapidly growing areas of use in healthcare
- Categorization framework is important for analysis and planning



TRACKING APPLICATIONS ACROSS MARKETS

Market	Application Group	Classification	Current Annual Volume	Supporting Technology (Supplier)
Medical/Dental	Medical Models	MPA	10 – 20 million	Photopolymerization / Material Jetting (many)
Medical	Orthopedic Implants	DPU	~60,000	Metal powder bed fusion (Arcam, EOS)
Medical	Hearing Aid Shells	DPU	~6 million	Photopolymerization (3D Systems, Envisiontec)
Dental	Dental Aligner Tools	MM	~27 million	Photopolymerization (3D Systems, Envisiontec)
Dental	Metal Dental Substructures	DPU	~5 million	Metal powder bed fusion (EOS, Concept)
Medical/Dental	Surgical Guides	MPA	1 – 2 million	Photopolymerization / Material Jetting (many)
Medical	Orthotics	DPU	3 to 5 thousand	Polymer powder bed fusion (3D Systems, EOS)

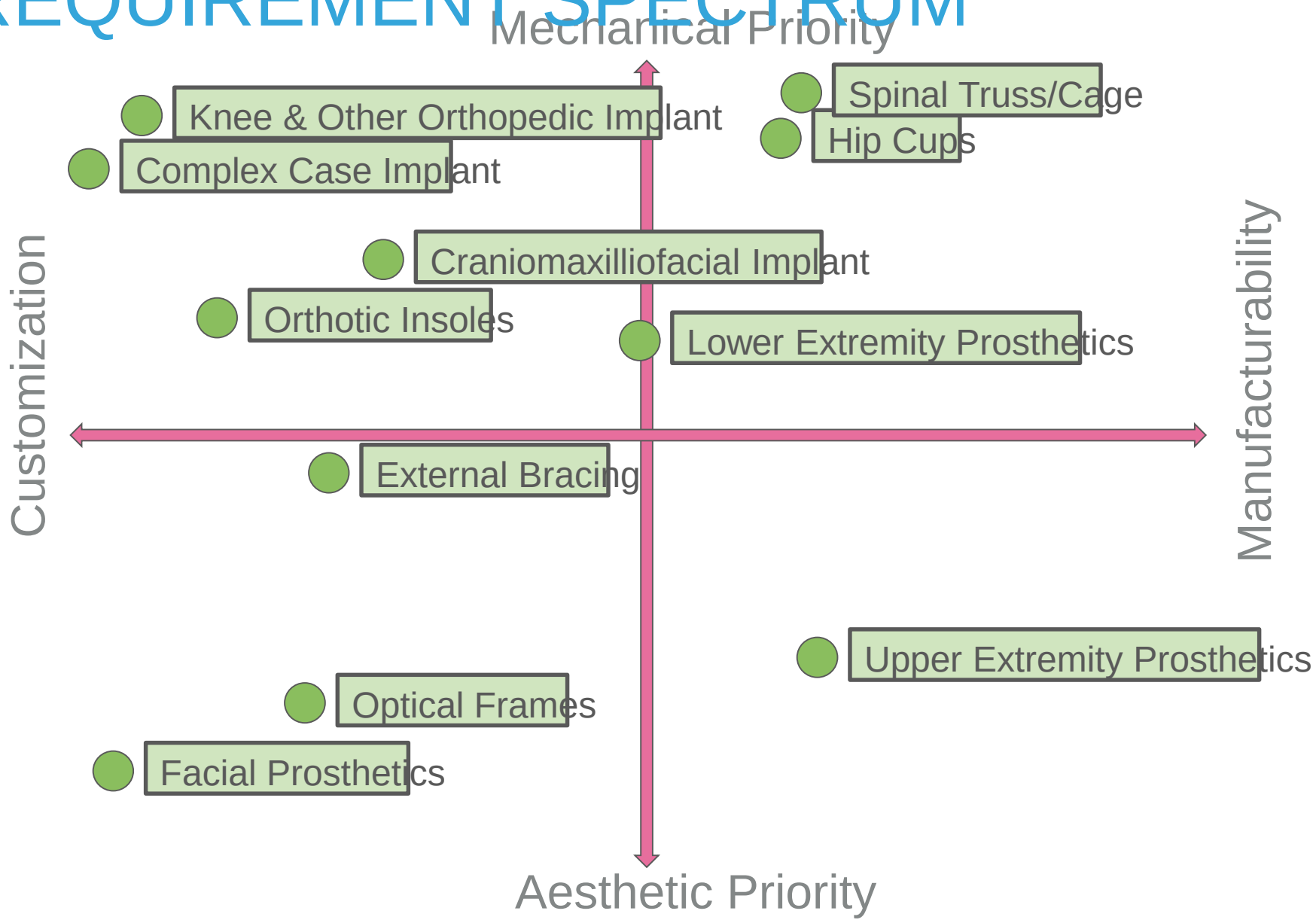
BREADTH OF APPLICATIONS CREATES COMPLEX PRINT TECHNOLOGY MARKET

- Considerations for additive manufacturing solution development becomes complex
- Clinical requirements, regulatory requirements, and technical requirements
- A number of new print materials have been developed to expand market potential for existing technologies

MEDICAL AM/3DP APPLICATION REQUIREMENT SPECTRUM

- Balancing mechanical performance properties with aesthetic properties
- Also balancing pure customization versus improvements in manufacturability / throughput
- In some cases these requirements aren’t necessarily mutually exclusive

MEDICAL AM/3DP APPLICATION REQUIREMENT SPECTRUM



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SECTION THREE

GROWTH IN MARKET AND CLINICAL

TWO TYPES OF ACCEPTANCE FOR HEALTHCARE PRINTING

- Clinical acceptance vs. Commercial acceptance
- The two are closely linked, but clinical acceptance has not always been a guarantee in the presence of commercial acceptance
- Clinical acceptance may be catching up to commercial acceptance – but there’s plenty more to be done

MAJOR MILESTONE IN CLINICAL ACCEPTANCE OF AM/3DP

- In May 2016, the FDA released a draft guidance for the additive fabrication of medical devices
- To date, 85 printed medical devices have been approved by the FDA, but most of these are not ‘high risk’ devices
- Approval for printed devices is still a significant challenge for developers of printed healthcare products, however the tides may be turning

BIG NAMES IN MEDICAL JUMPING INTO AM/3DP

- Q1 2016 FDA Approval – Zimmer Arthrodesis system builds on proven success of Electron Beam Melting in orthopedics

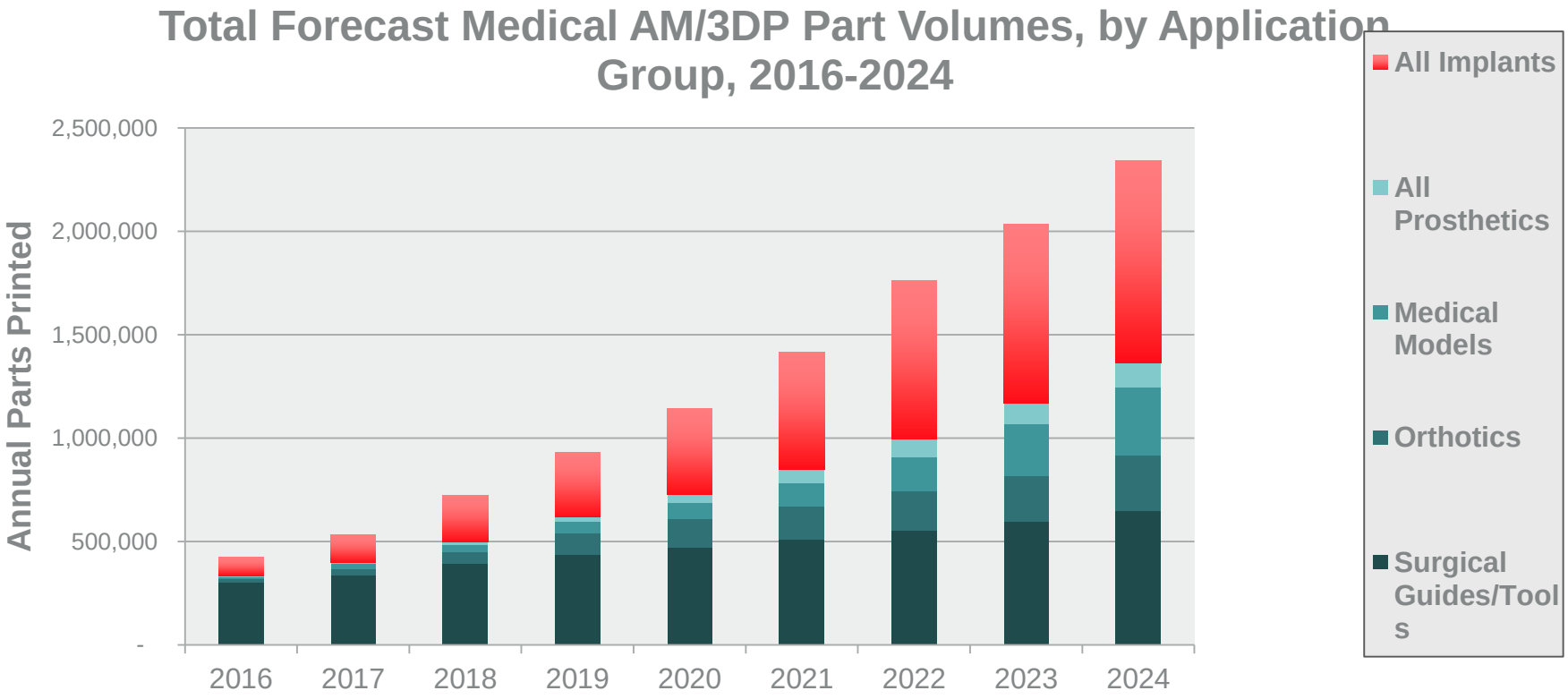
Zimmer “Unite3D” System

- Q2 2016 Market release – Stryker Corp

Stryker PL Cage

NOT JUST ABOUT METAL IMPLANTS

- Applications are expanding extremely rapidly for modeling, prosthetics, orthotics, and personalized surgery mostly through specialty developers

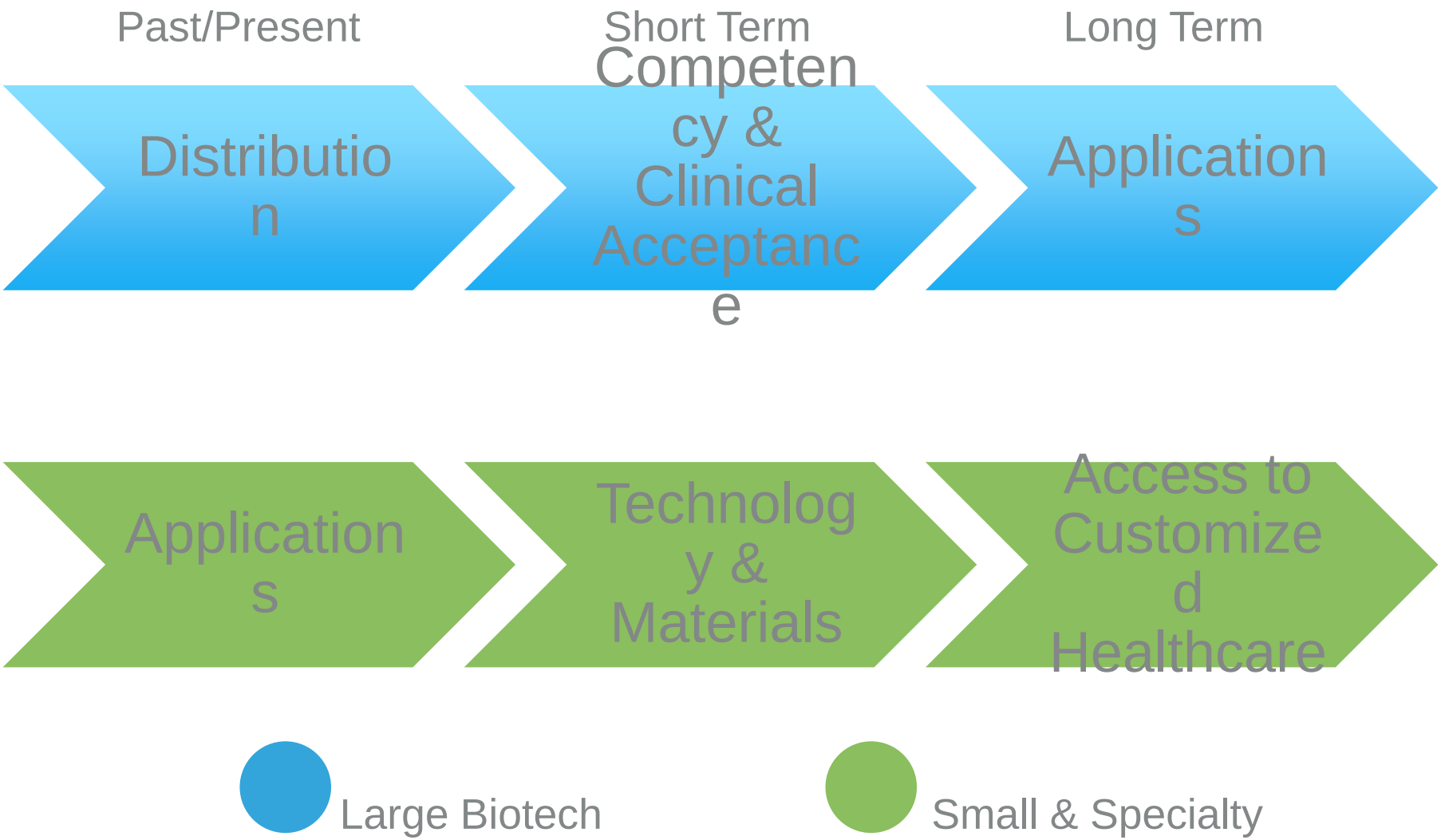


Source: SmarTech Publishing (Various Reports)

SECTION FOUR

THE FUTURE OF AM/3DP IN HEALTHCARE

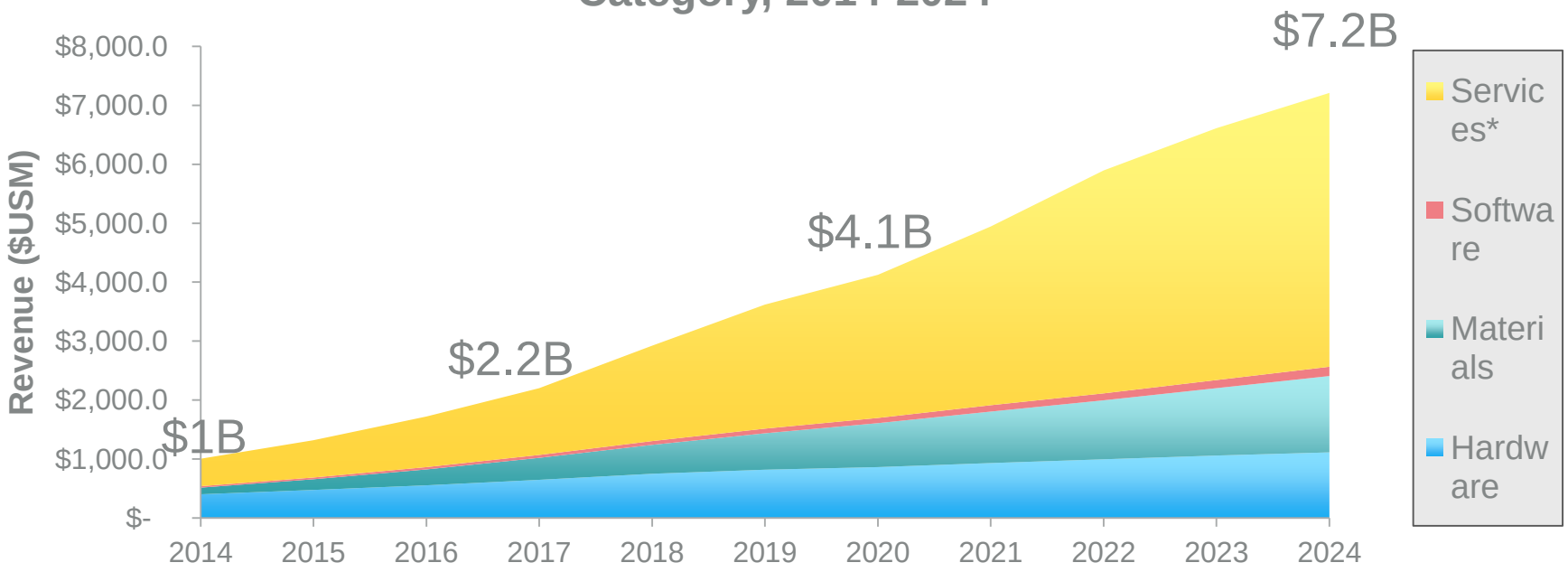
EXPECTED FUTURE DEVELOPMENT TRENDS



AM/3DP HEALTHCARE MARKET EXPANSION TRENDS

- Total combined medical/dental opportunities expected to grow 19.6 percent CAGR from today through 2024
- Services estimation is based on value of applications, key target for next generation healthcare AM/3DP reporting
- Value of software expected to grow more rapidly in the future

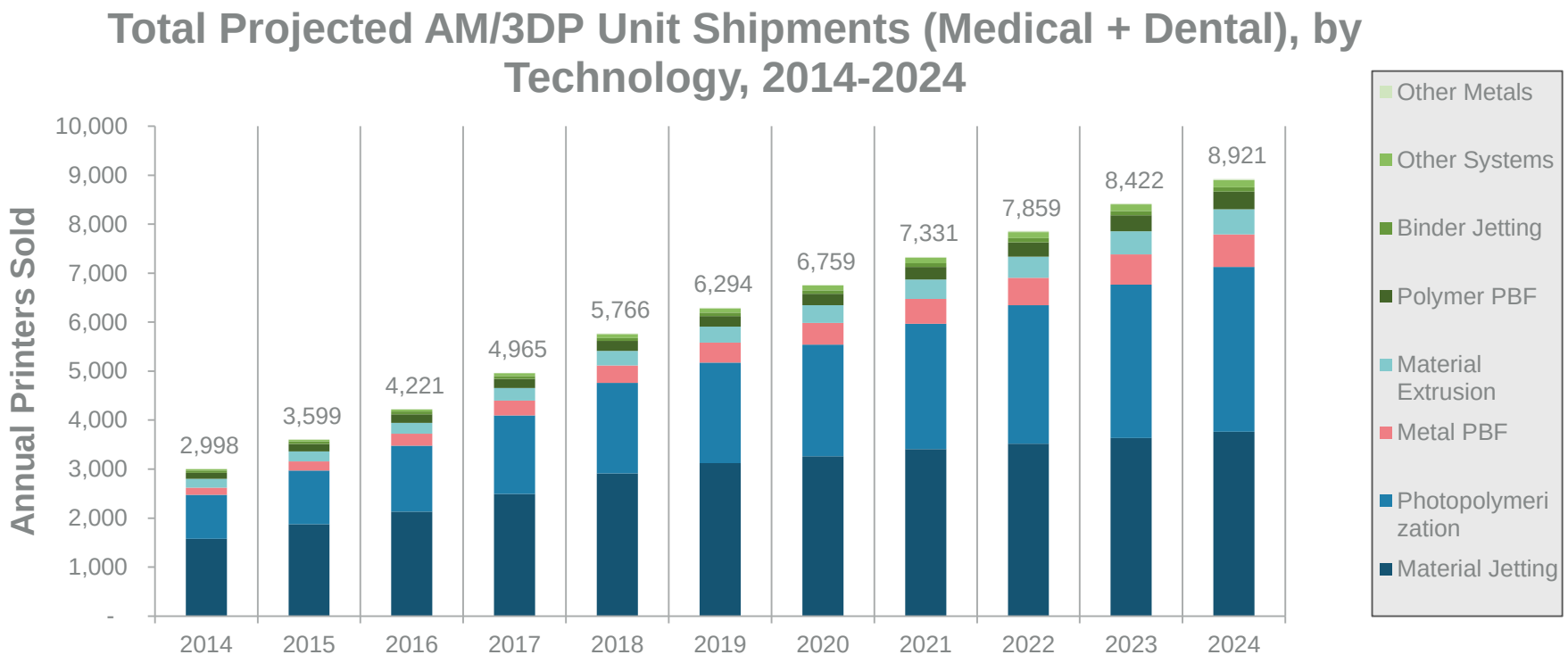
Total Projected Combined Healthcare AM/3DP Opportunity, by Category, 2014-2024



Source: SmarTech Publishing (Various Reports)

AM TECHNOLOGIES POWERING HEALTHCARE GROWTH

- Significant growth in technologies that can play in both markets (medical + dental) to a high degree
  - Photopolymerization and metal powder bed fusion are the primary candidates
- Material extrusion, polymer powder bed are particularly strong in certain instances but not as strong in several high volume applications



OUR FUTURE AM/3DP HEALTHCARE WORLDVIEW

- Increased access to healthcare is the future for AM/3DP technologies in this field
- We are watching very intently how AM/3DP penetrates primary care environments – dental offices, hospitals, and specialty medical practices
- Historical expectations of labs and service providers being the exclusive users of AM 3DP in healthcare could shift over the next decade

THANK YOU

- Ask Me Questions: scott@smartechpublishing.com
- www.smartechpublishing.com - 434-872-9008
- Visit us in the exhibit hall booth 1006
- Join us for the panel discussion later this afternoon