

Industrial 3D printing with polymers: current and future trends

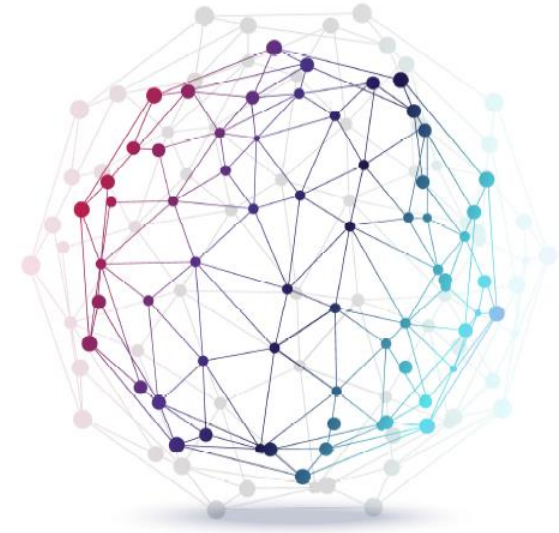
Gustavo Gonzalez

Technology Analyst

AIRI – Italian Association for Industrial Research

Agenda

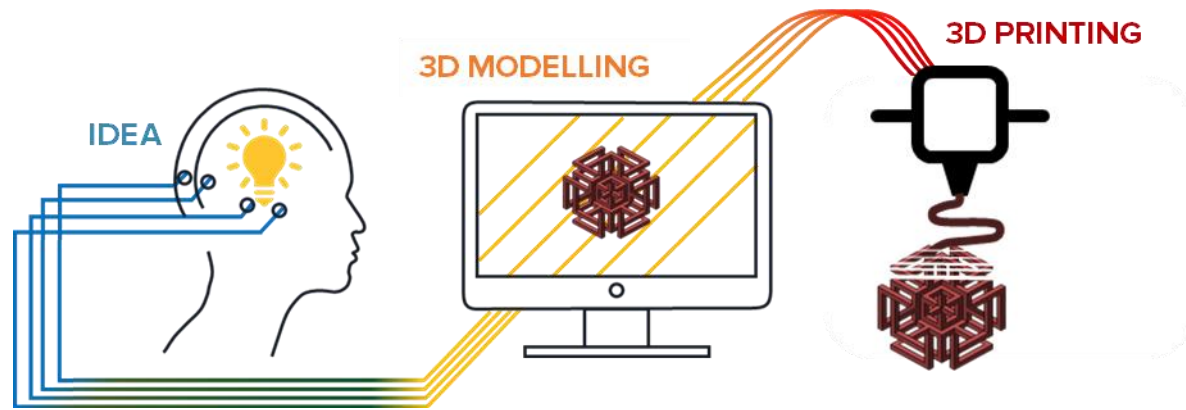
- 3D printing overview
- 3DP supply chain
- 3DP market dynamics and trend
- 3DP applications
- Conclusions



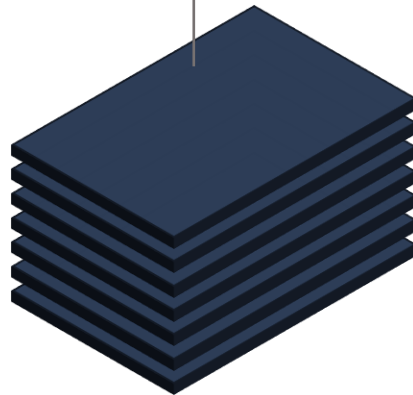
3D PRINTING



3D printing



Layer-by-layer



<https://www.solidsmack.com/>

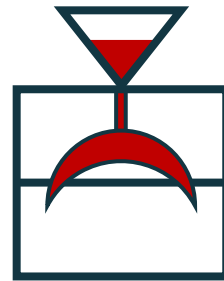


<http://www.reify-3d.com/products/>

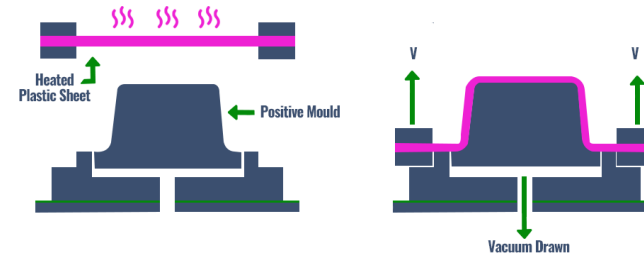
3D printing vs conventional methods



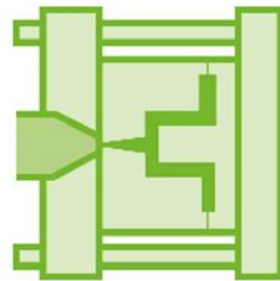
casting



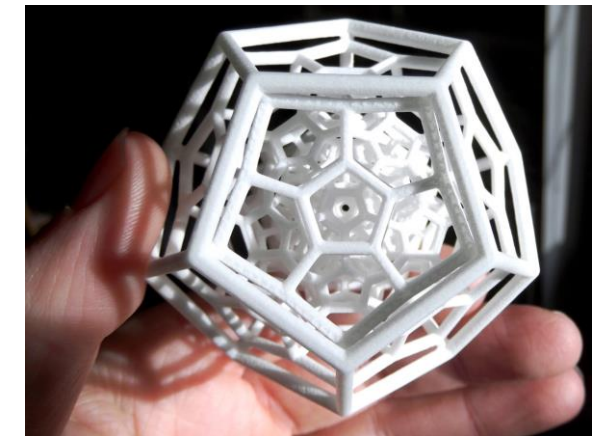
forming



molding

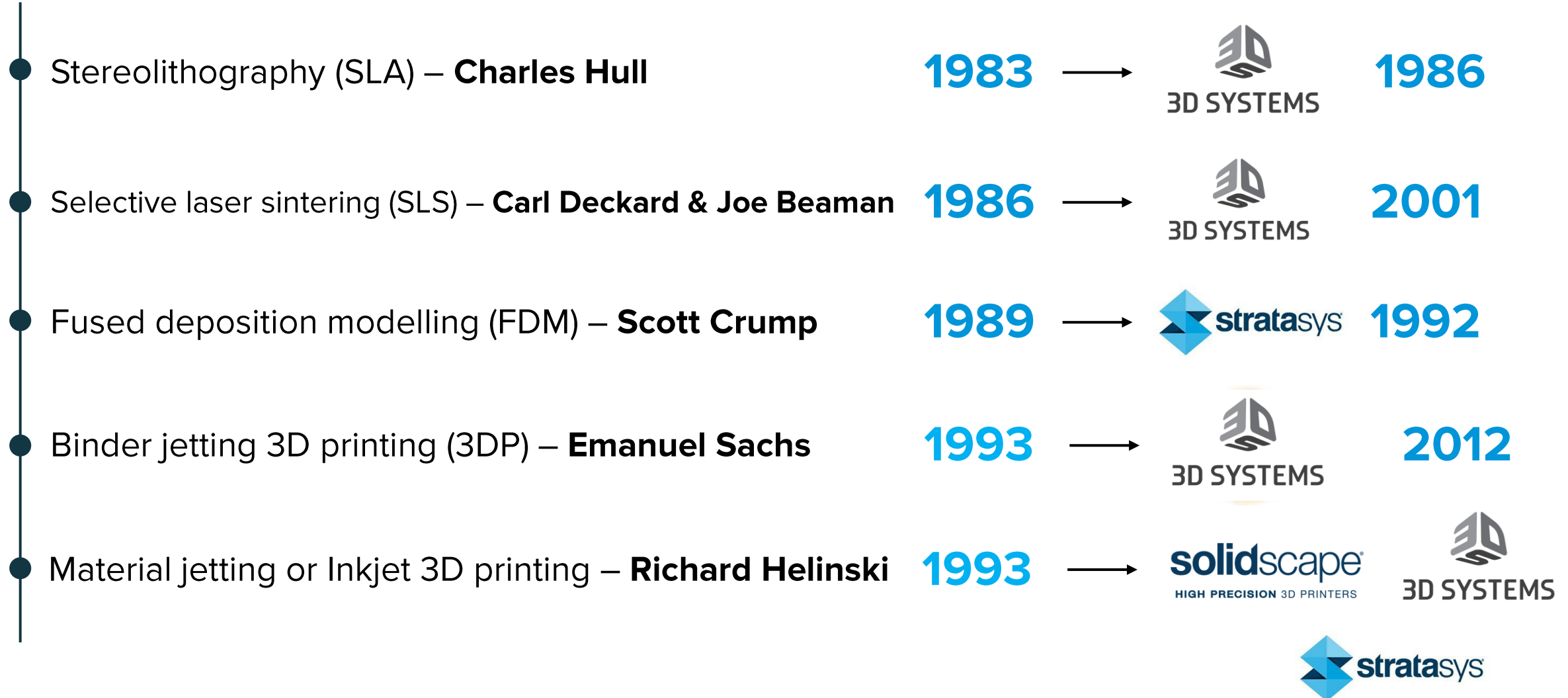


3D printing

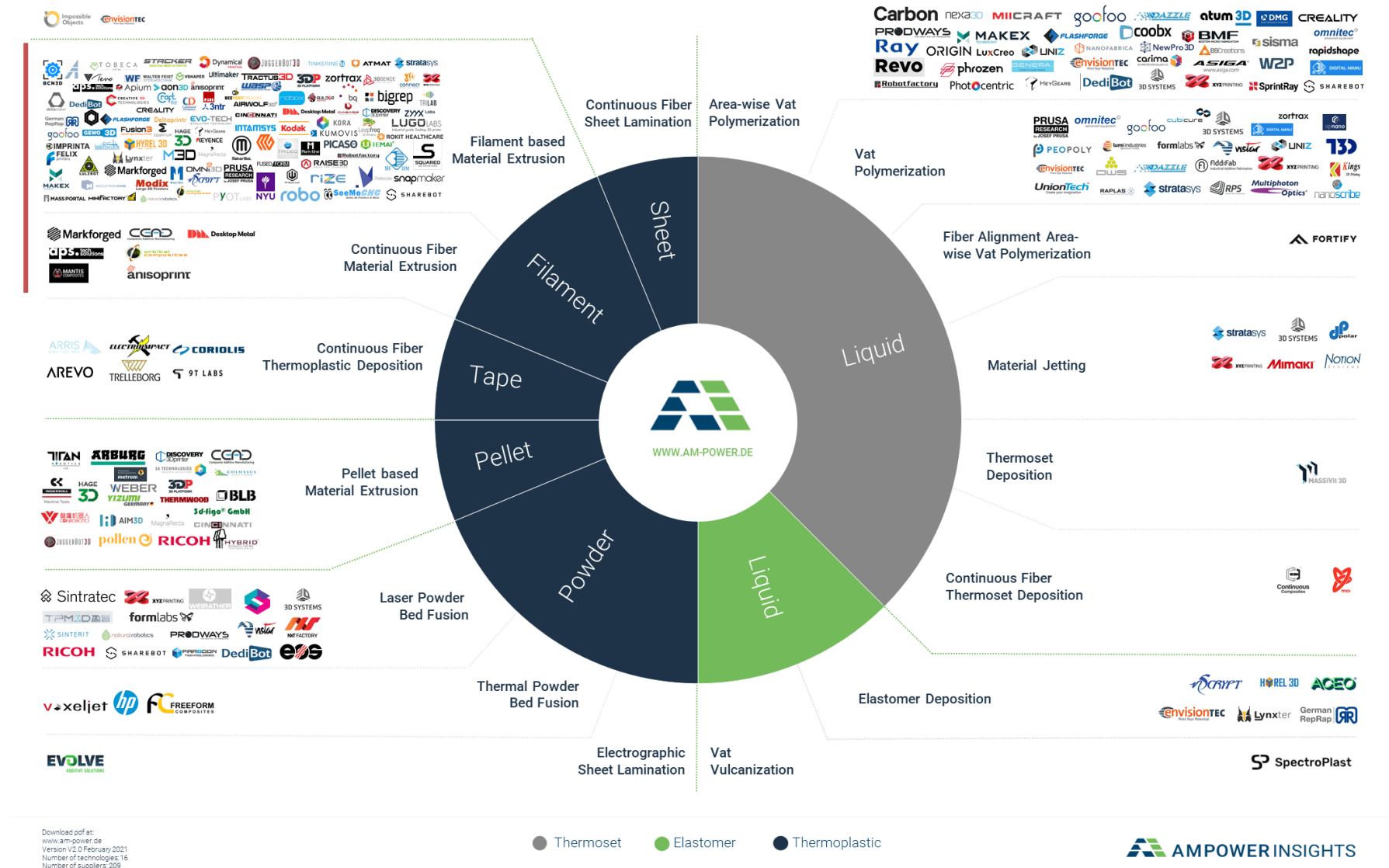


<https://thejetstreamjournal.com>

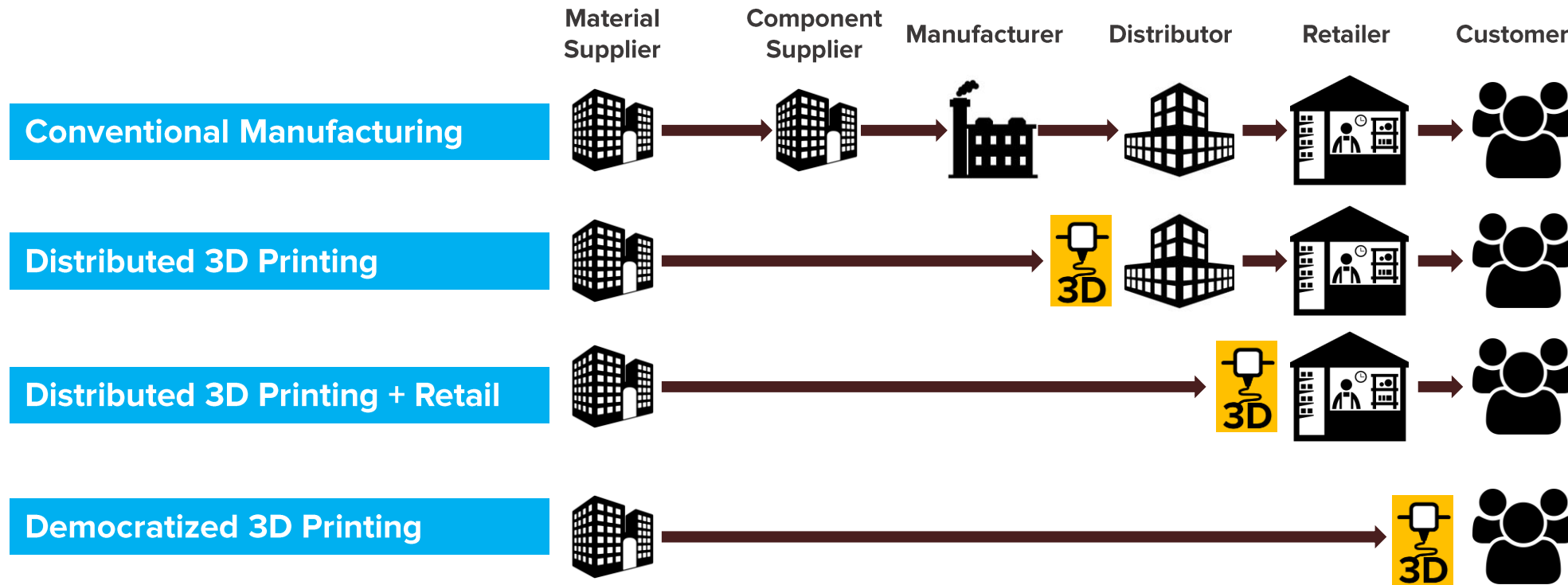
3D PRINTING, a brief history



3D printing, main actors

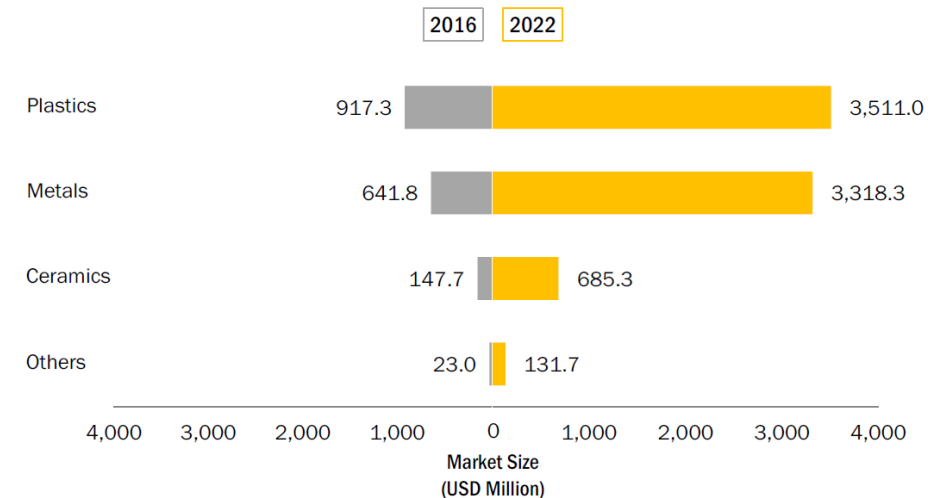
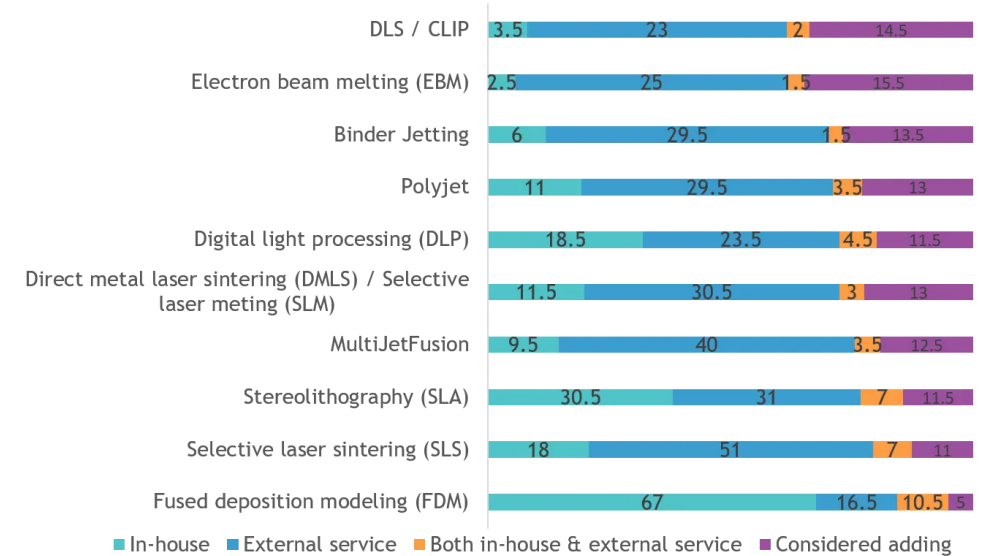
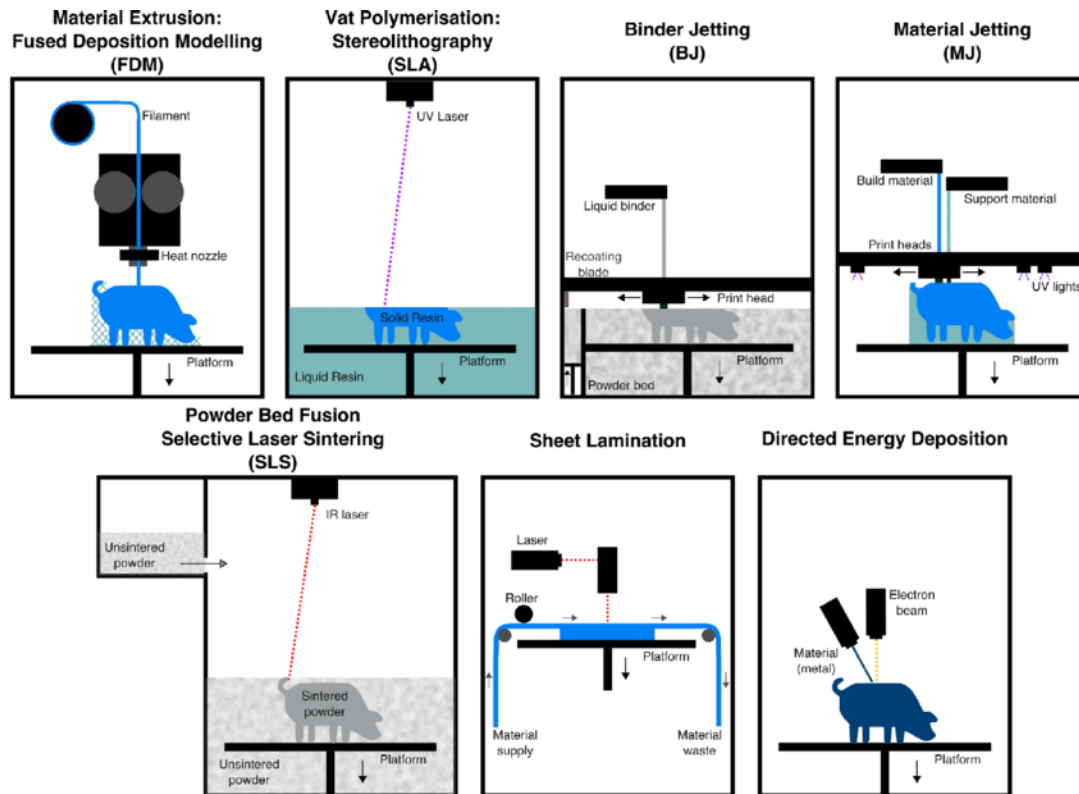


3D printing, supply chain



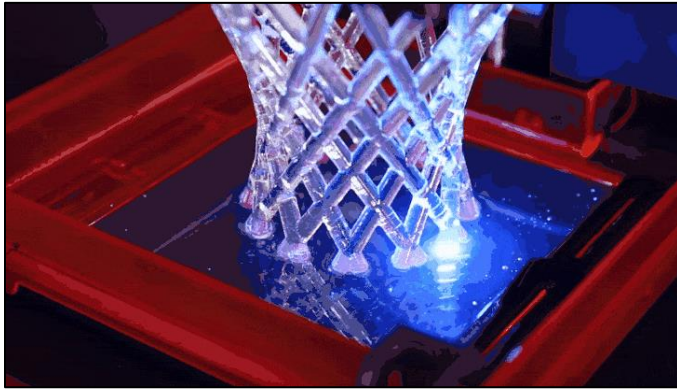
3D printing can reduce design times and the production of functional parts

3D printing, types

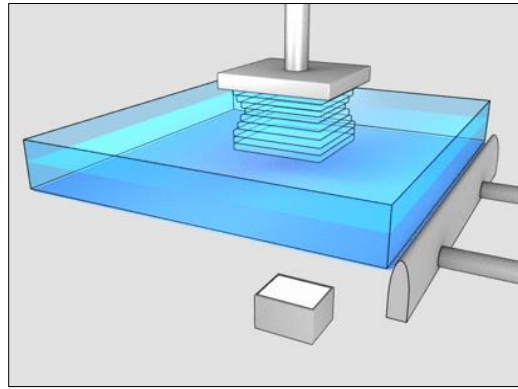


3D printing, main techniques

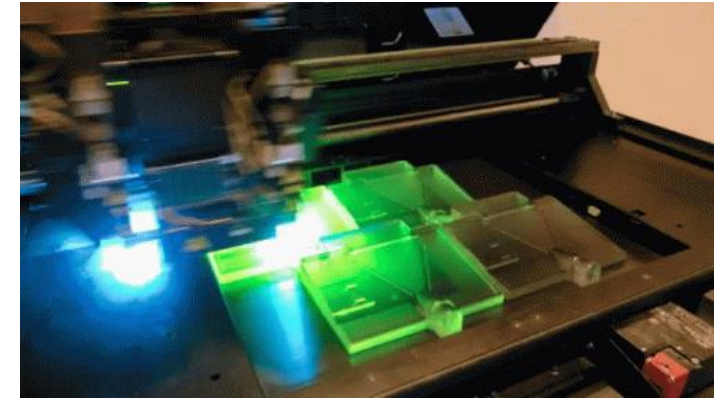
Stereolithography (SLA)



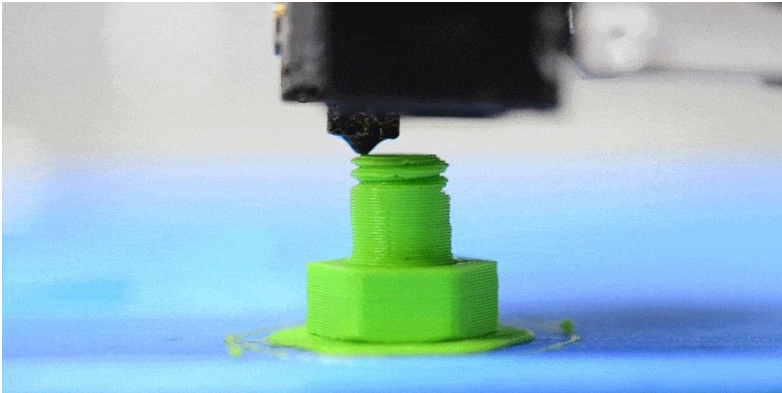
Digital light processing (DLP)



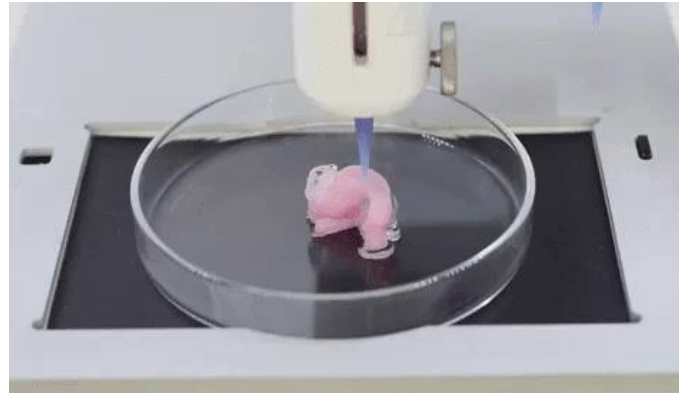
Polyjet 3D printing



Fused deposition modeling (FDM)



Bioplotting



Binder 3D printing



3D printing, market dynamics

TECHETHOS

FUTURE ○ TECHNOLOGY ○ ETHICS

<https://www.techethos.eu>

STRENGTHS

1. Ease in developing customized products
2. Few instruments needed
3. Public investments in the sector

LIMITS

1. Limited availability and high cost of materials
2. Product size limitation
3. Lack of control standards

OPPORTUNITIES

1. Potential to improve production and supply chain
2. Expansion of the market for end-user industries

CHALLENGES

1. Guarantee the quality of the product
2. Limited design tools

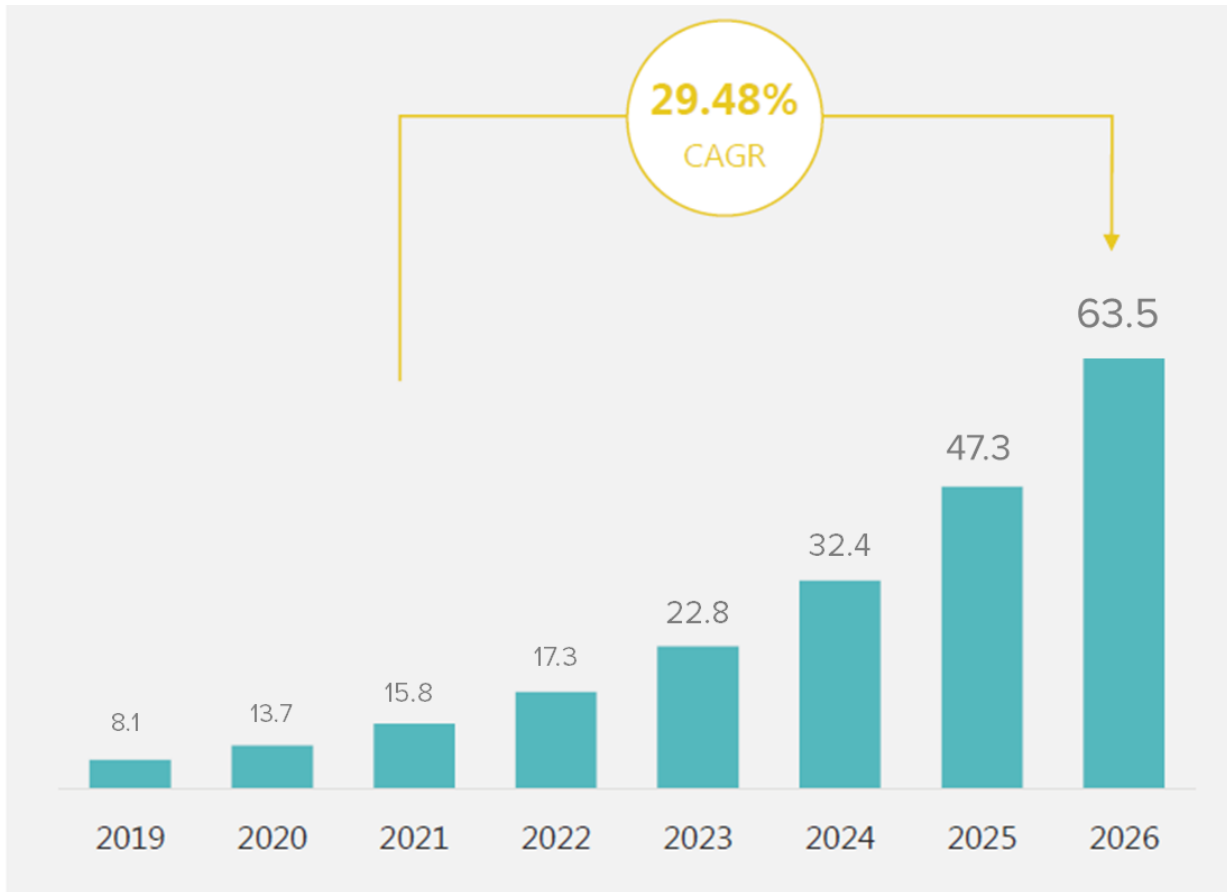
3D printing, risks and opportunities

TECHNOLOGY	Scalability Production of customized products of any shape
MARKET	Competitive advantage over conventional manufacturing methods Low-volume production Changes along the supply chain
SAFETY	3D printing risk assessment and management Standard and international harmonization Regulatory requirements and developments (regulatory uncertainty)
SOCIAL IMPACT	Benefit / risk ratio Perception of risk, expectations and ELSA needs of the company and specific applications (e.g., medicine, cosmetics, etc.)



3D printing market

Revenue in USD Billion | Global, 2019-2026



Growing factors:

- Ease of developing customized products
- Reduction in manufacturing cost
- Government investments in 3D printing projects
- Reducing prices of printers

Things to consider:

- Printer technical characteristics
- The ability to use 3D printer
- Cost/benefit ratio from the investment.

3D printing trends

3D printing as a business solution

- It creates value in product designing and manufacturing
- Mass customization
- Shorter production times
- Simplification of supply chain
- Reduction of material waste



Shift toward service providers for functional parts

Companies have started providing services such as rapid prototyping, concept models and functional prototypes.

Entry of printing giants in the 3D printing market

Big companies in the 3D printing industry:

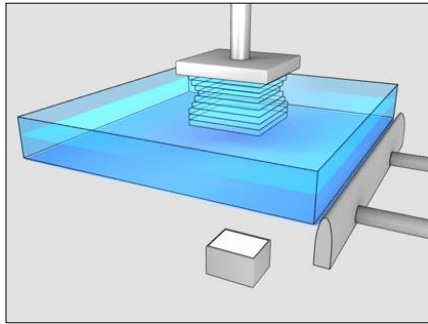
HP, Canon, Epson and Ricoh

Canon

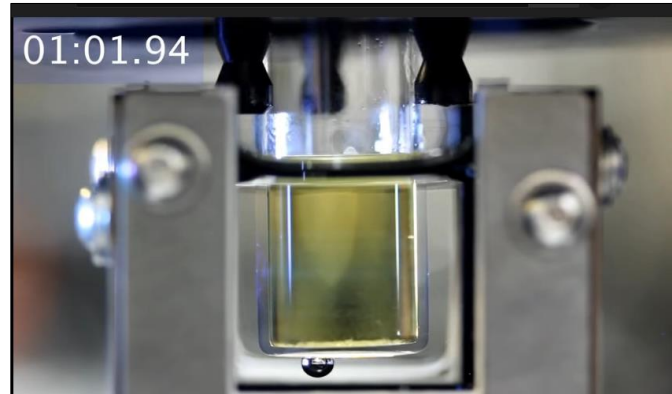


3D printing tech trends

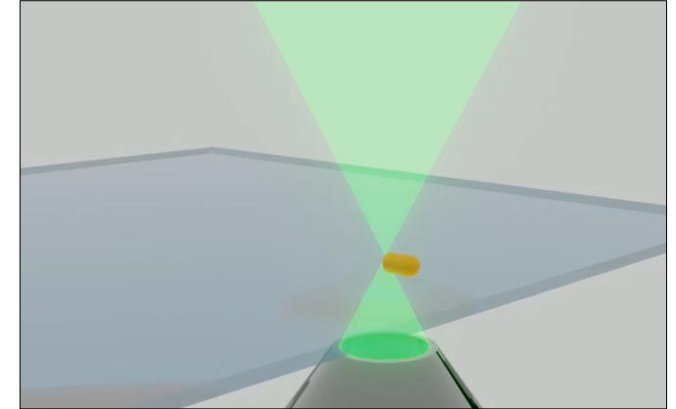
Continuous liquid interface (CLIP)



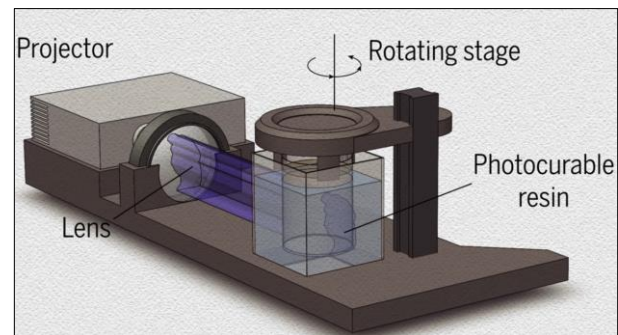
Computed axial lithography (CAL)



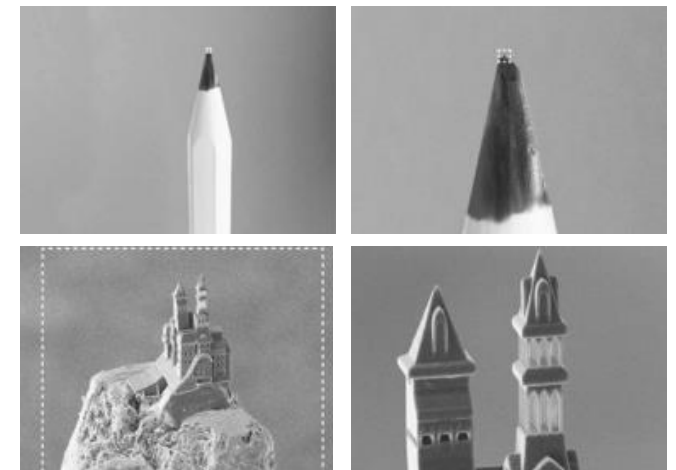
Two-photon lithography (2PP)



<https://www.carbon3d.com/>



<https://www.science.org/>



<https://amt.tuwien.ac.at/>

3D printing material trends

Filament made from renewable and natural materials

Extruder Green-TEC has a bio-organic

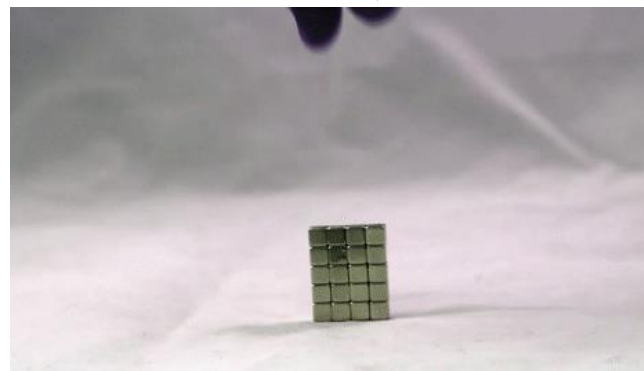


3D printer for recycled bottles



<https://www.3dprinterros.com/>

Magnetic thermoplastics



<https://3dprint.com/>

Shape-shifting polymer

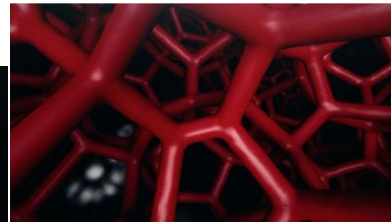
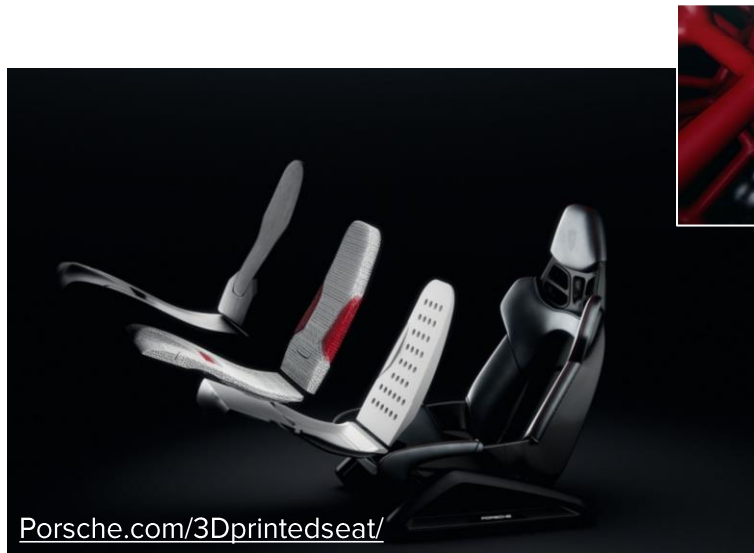


<https://phys.org/>

4D printing - 3D printed structures transform in response to stimuli

<https://www.nature.com/>

3D printing, applications



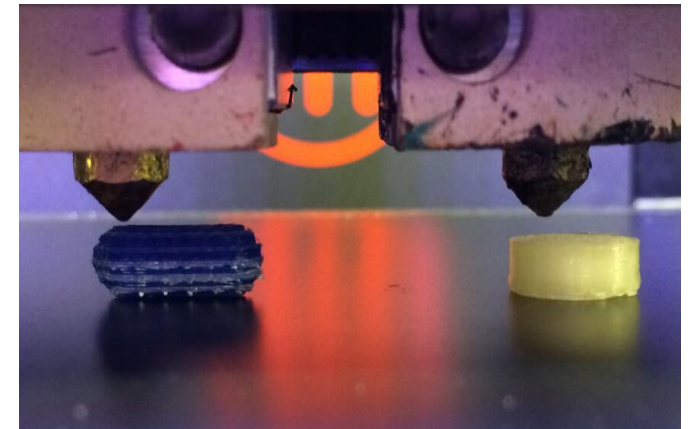
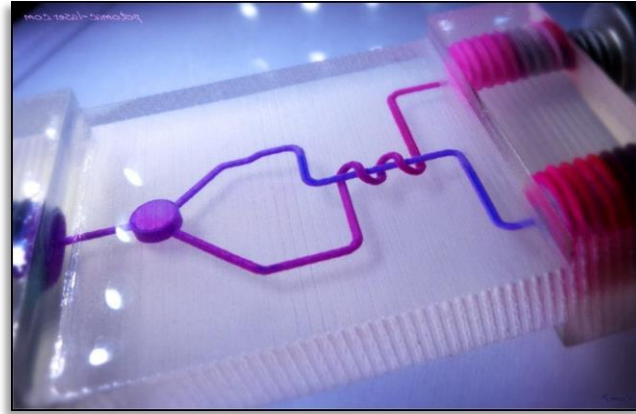
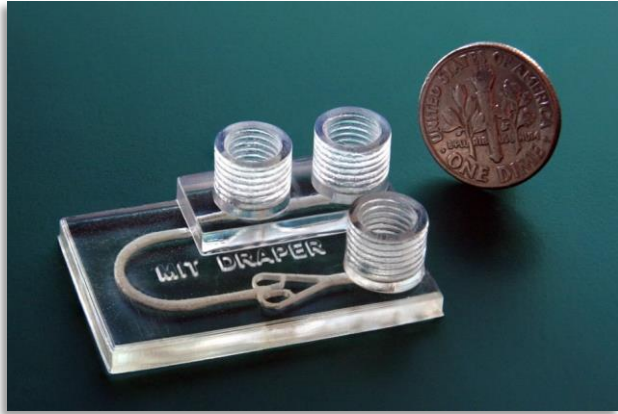
3D printing, applications



<https://www.isinnova.it/easy-covid19-eng/>

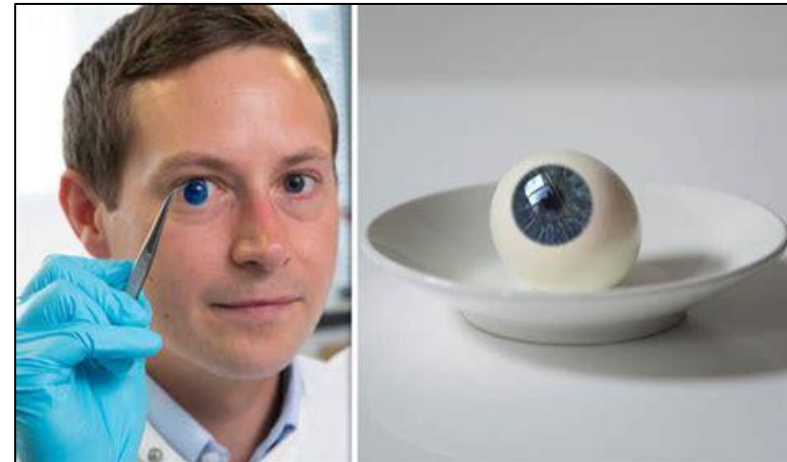
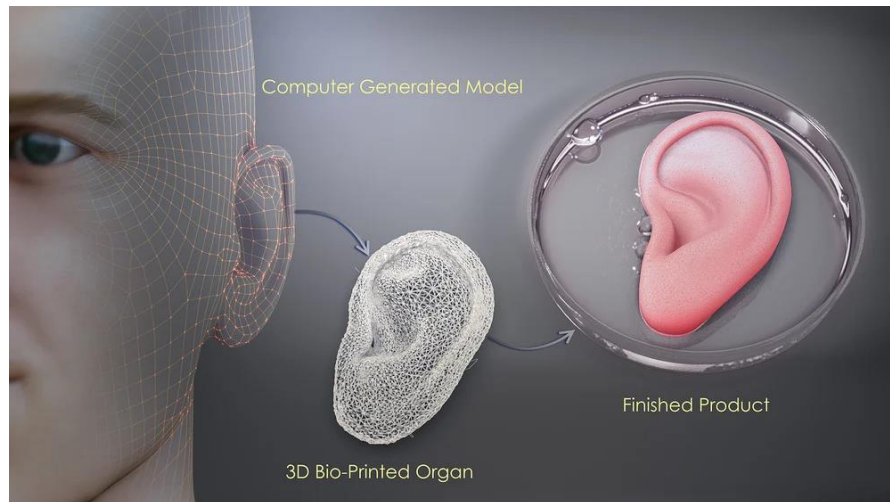
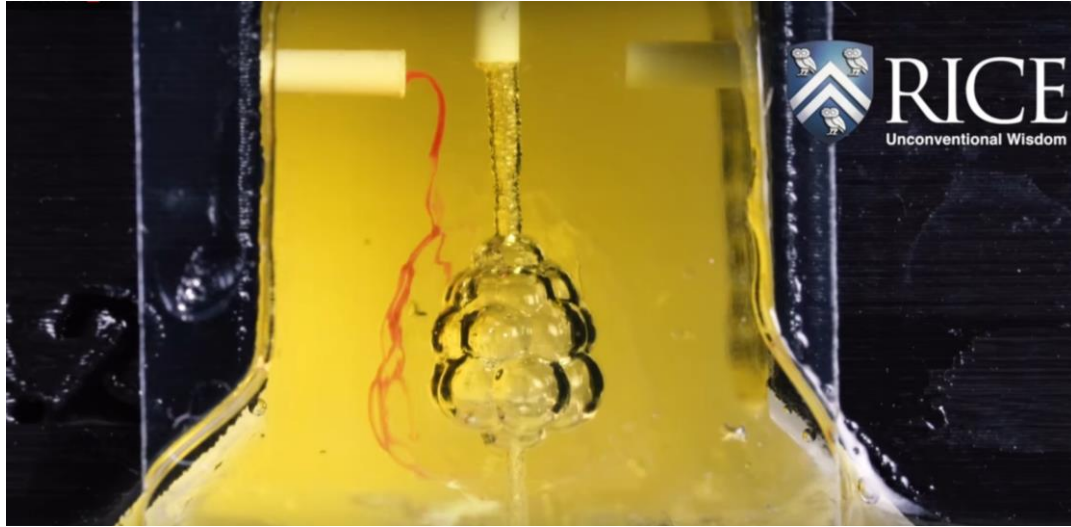


3D printing, applications



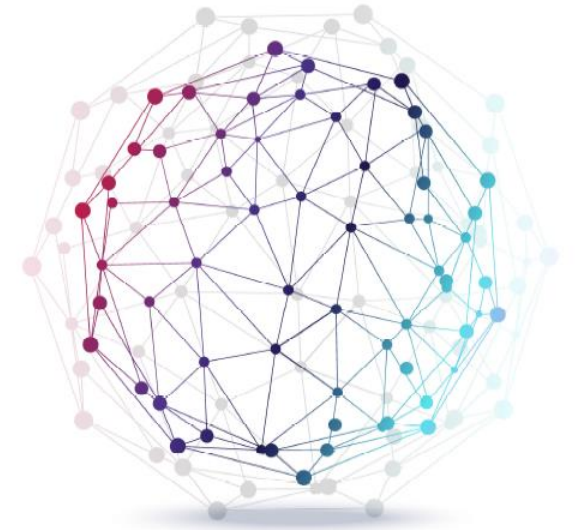
<https://pubmed.ncbi.nlm.nih.gov/33540014/>

3D printing, applications



Conclusions

- **3D printing is continuously growing**
- **New materials and techniques can drive 3D printing innovation**
- **3D printing can change supply chain**
- **3DP might create news business opportunities**





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Thank you



Societal engagement on enabling technologies

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Ethics of new and emerging technologies

techethos.eu



Risk governance of nanotechnologies

gov4nano.eu



Conference & Exhibition on KETs & Nano

nanoinnovation.eu

