Fab Labs: A Blueprint for Decentral Production?

3D Printing Technology Landscape for Metal Production in Digital Manufacturing Workshops

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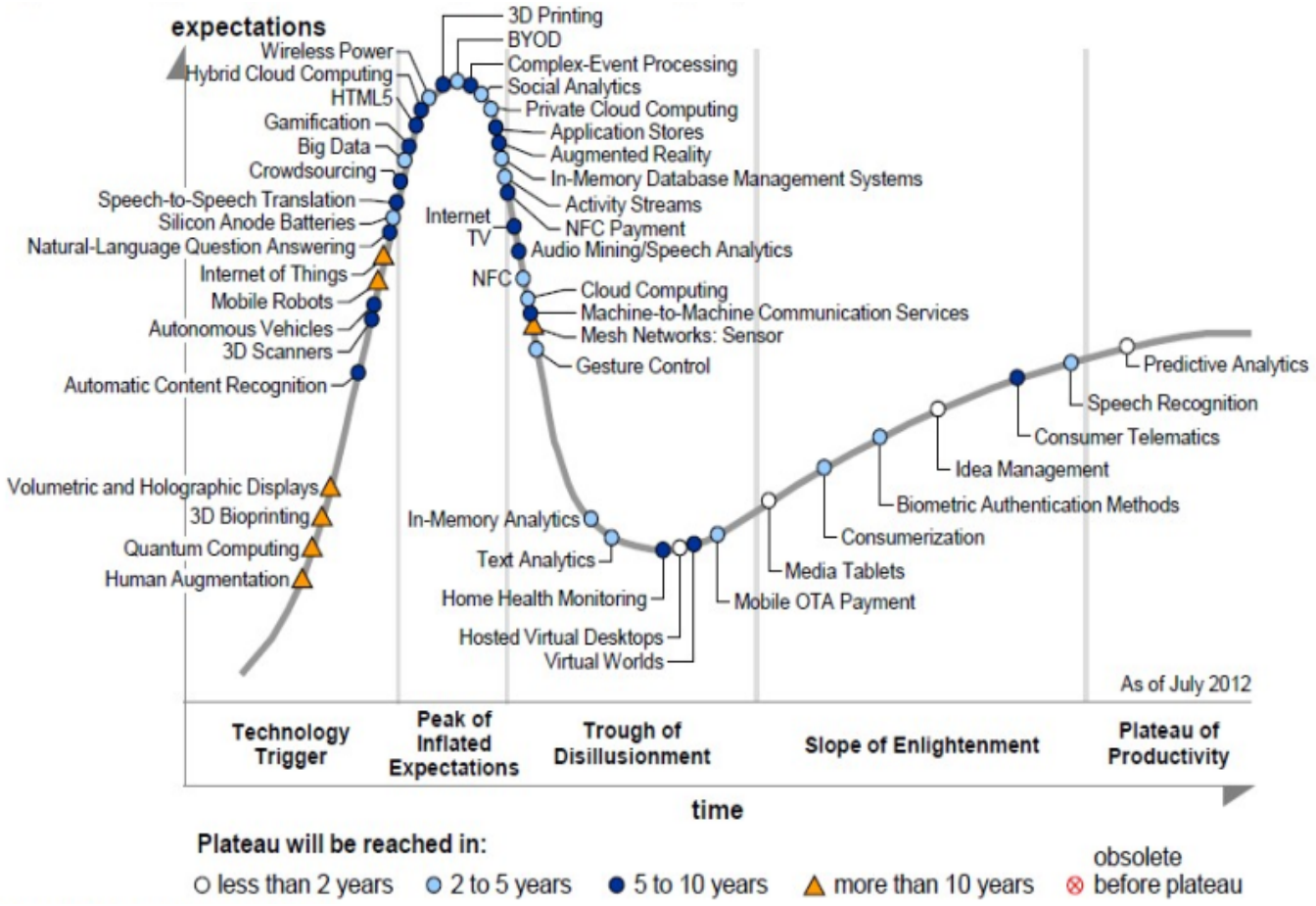
Agenda

1 **Motivation and state-of-art**

2 **Technology landscape**

3 **Summary and conclusion**

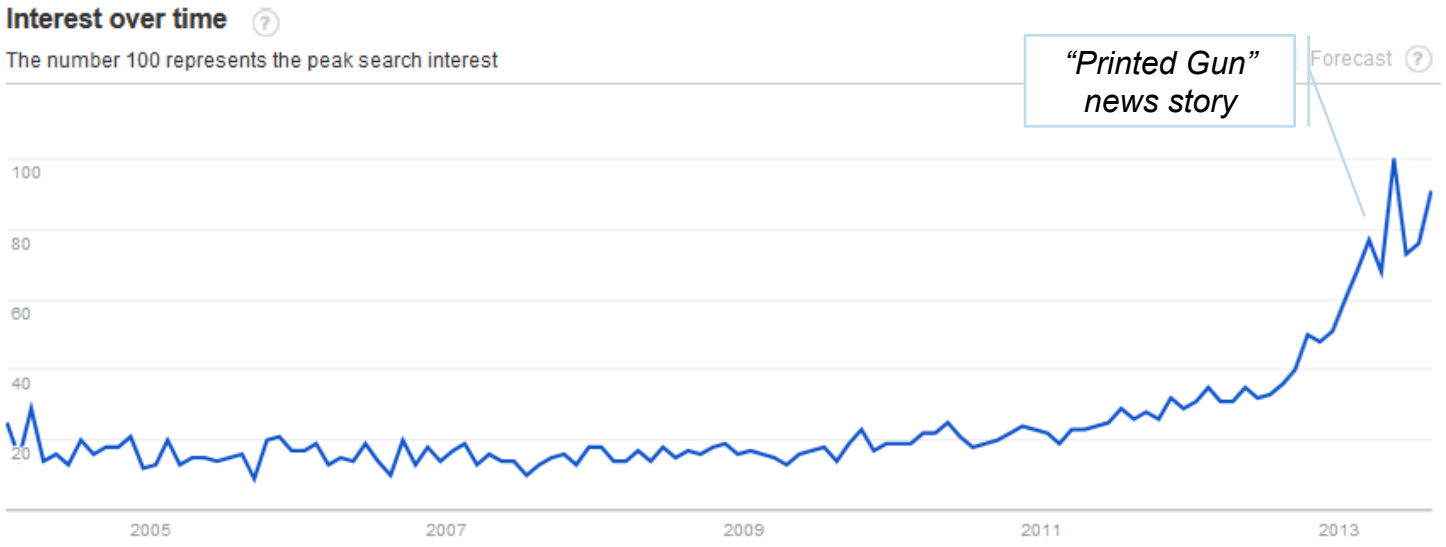
Yes, 3D printing currently being hyped...



Source: Gartner (2012), http://www.gartner.com/newsroom/id/2124315

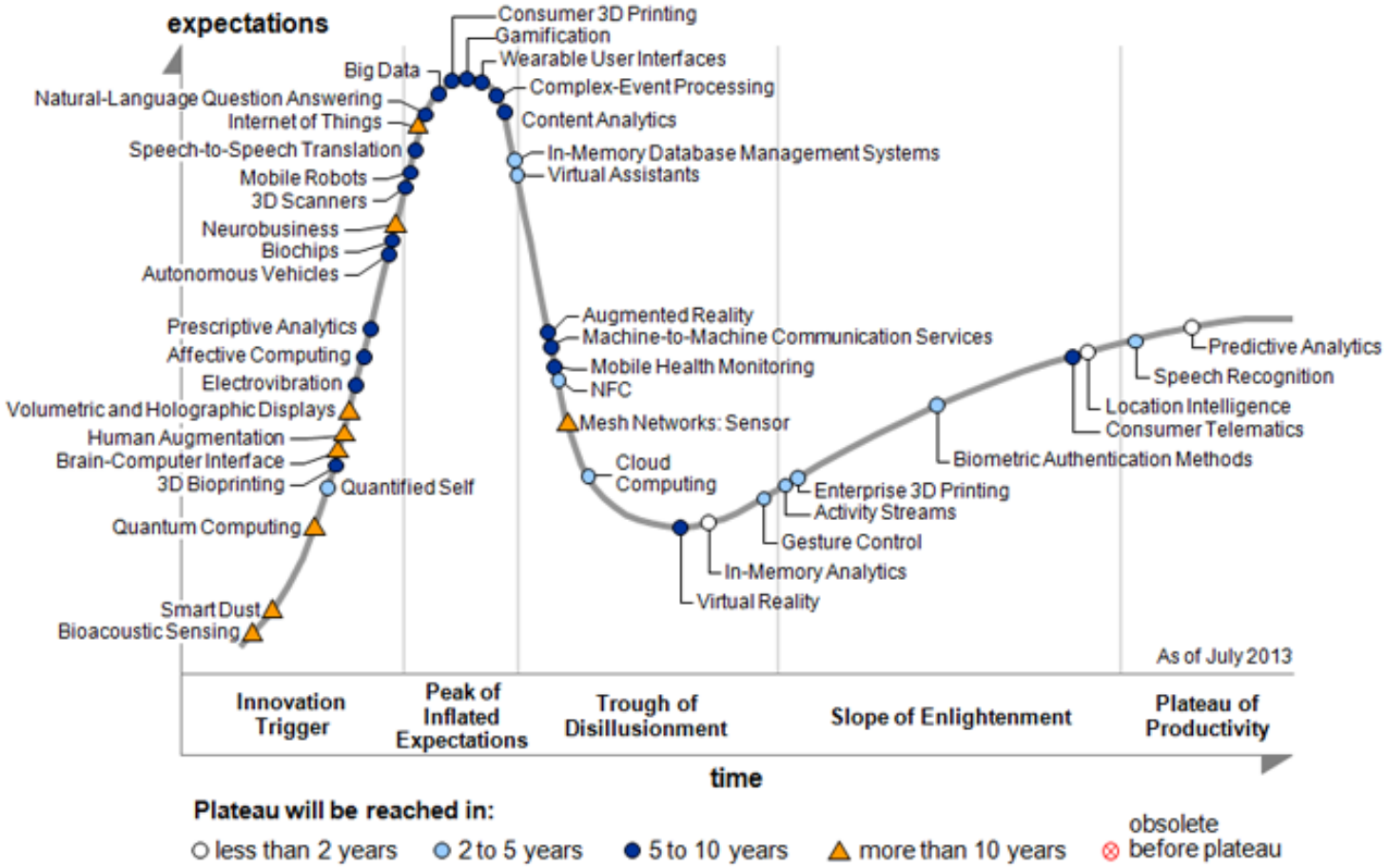
… as search volumes indicate, too

Search interest devel-opment 2004-2013



Source: Google Trends Peak Search Interest for "3D print*"

… with “enlightenment” being reached for industrial applications



Source: Gartner (2013), http://www.gartner.com/newsroom/id/2575515

Emerging business opportunities for consumer & industrial applications with market size of 10.8 billion USD by 2021

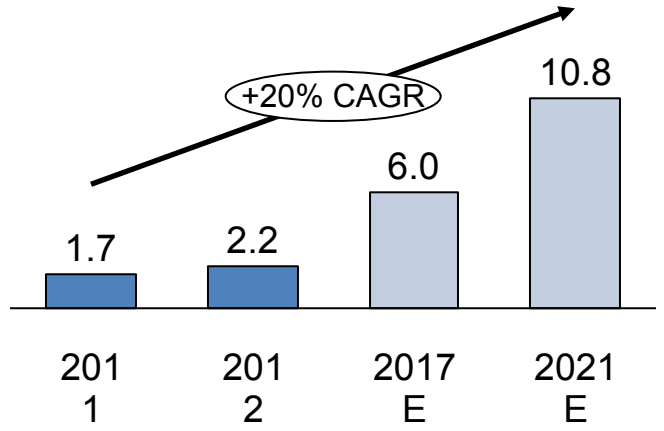
Consumer applications

- 3D printing services
  - 3D model repository (e.g., Thingiverse, Shapeways)
  - 3D printing capacities (e.g., Sculpteo, Trinckle, Panashape)
- 3D printer for home use
  - E.g., Makerbot (just recently acquired by Stratasys for 400M USD, a ~30x sales multiple), Cubify
- 3D printed, customized products
  - E.g., Twikit (Medals, Trophies), 3DMe (figurines)

Industrial applications

- Professional 3D printing services
  - Rapid prototyping
  - Rapid manufacturing
  - Rapid tooling
- 3D printer for professional manufacturing use
  - E.g., EOS, Stratasys, ExOne

Market development (billion USD) for 3D printing devices, products and services



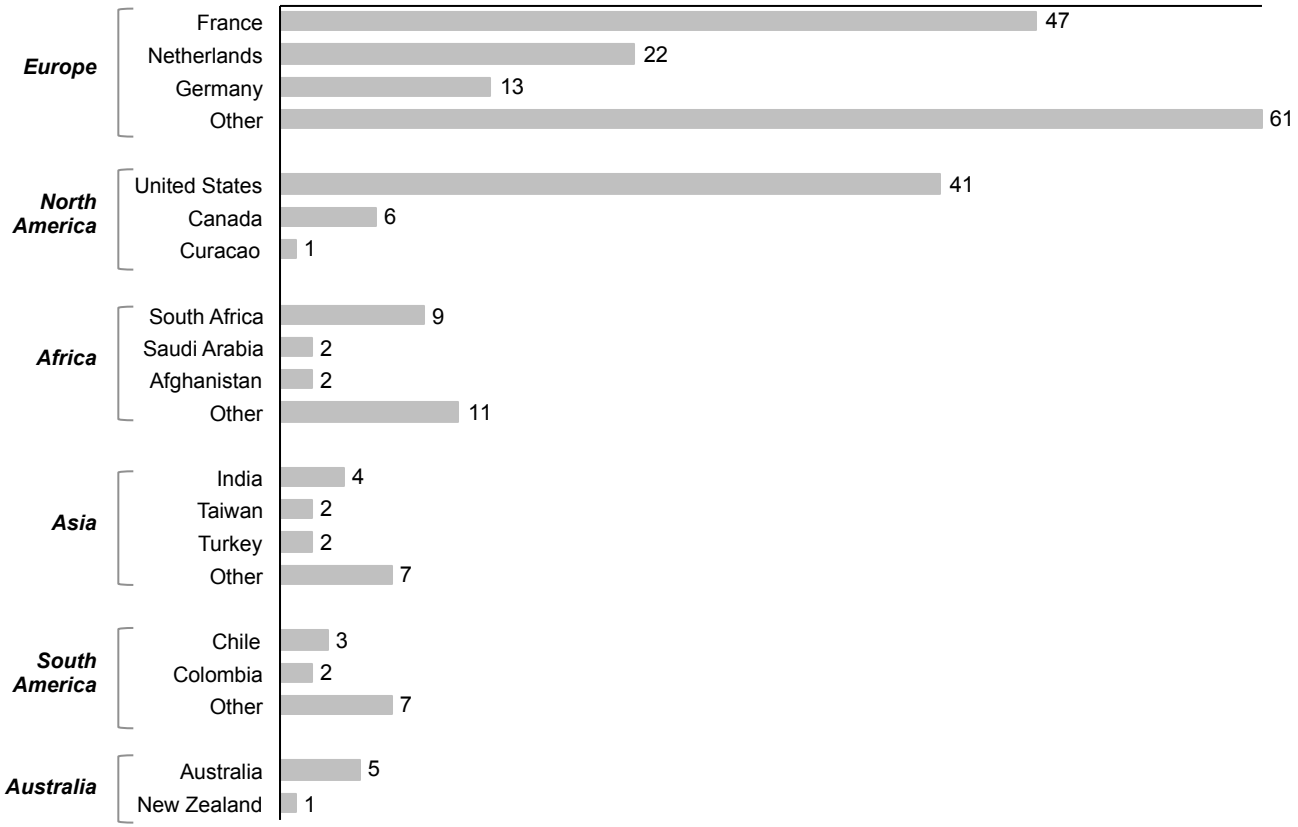
Source: Wohlers (2013), Stratasys (2013): http://investors.stratasys.com/releasedetail.cfm?ReleaseID=772534

A new industrial revolution?

The Economist, April 2012

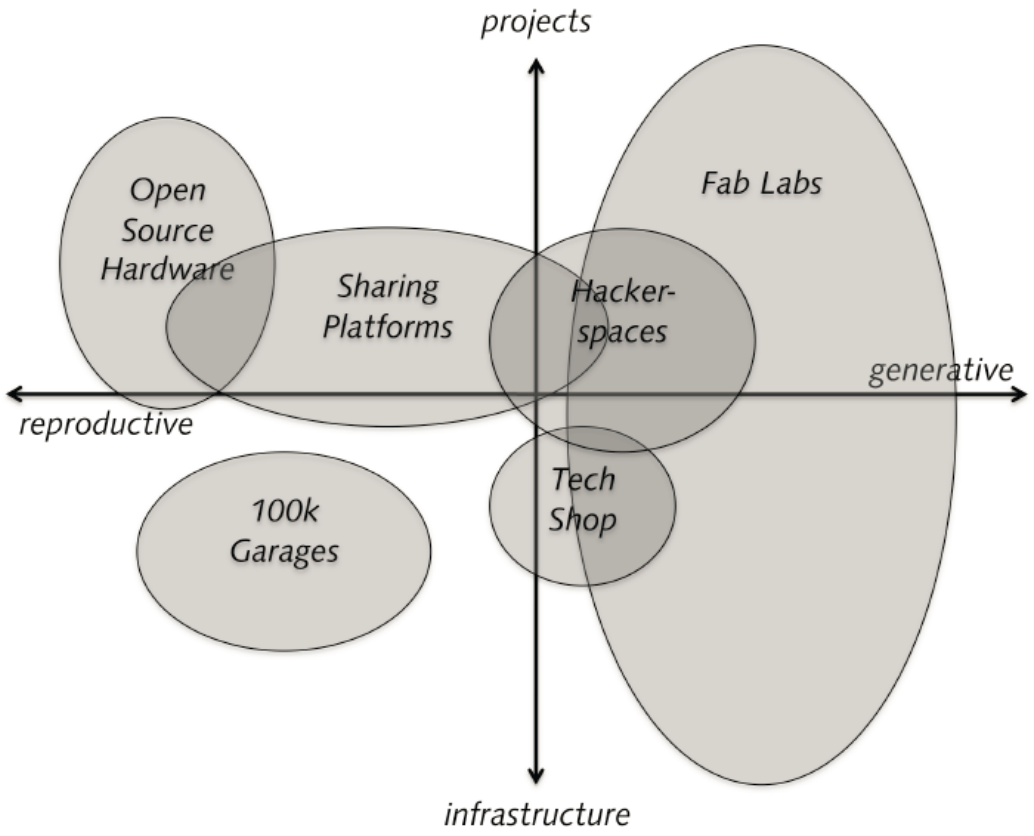
Fab Labs: globally distributed but (yet?) concentrated in Europe & North America, many offer 3D printing

Number of Fab Labs as of August 2013



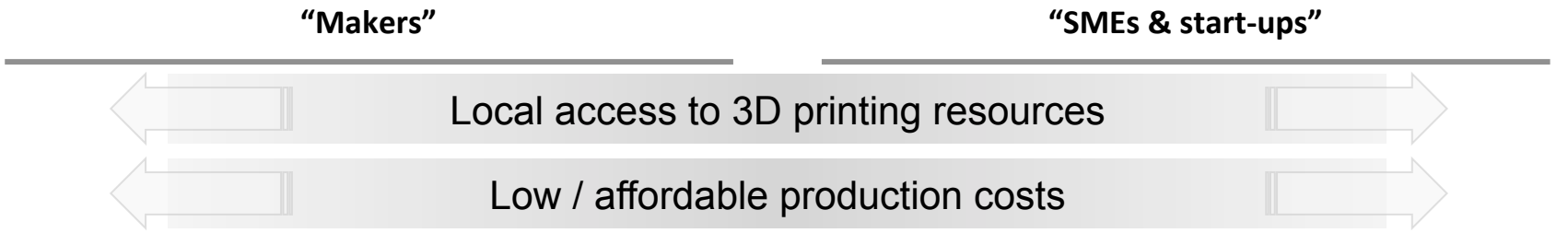
Source: FabWiki (2013)

The “fabbing world” is more than Fab Labs



Source: Troxler (2010)

What professional users (SMEs, start-ups) expect from digital mfg. workshops partly differs from requirements of “makers”



- Education
- Personal empowerment (make things)
- Fostering innovation (“peer-production”)
- Community-building
- Knowledge exchange

- Speed
- High quality of parts
- Reliability and reproducibility
- Availability of support and documentation
- Securing intellectual property
- Access to community and open design

Mostly “plastic gadgets” for home use

Mostly industrial metal end-use parts for e.g., automotive, aerospace, medical

Digital manufacturing workshops that commercially offer 3D printing solutions emerge, too

“The UPS Store Makes 3D Printing Accessible to Start-Ups and Small Business Owners

San Diego, July 31, 2013

The UPS Store® today announced it is the first nationwide retailer to test 3D printing services in-store. Select UPS Store locations will be offering the services to start-ups, small businesses and retail customers, beginning in the San Diego area with locations in additional cities across the United States in the near future. […]”

Source: https://www.theupsstore.com/about/media-room/Pages/3D-printing-accessible.aspx

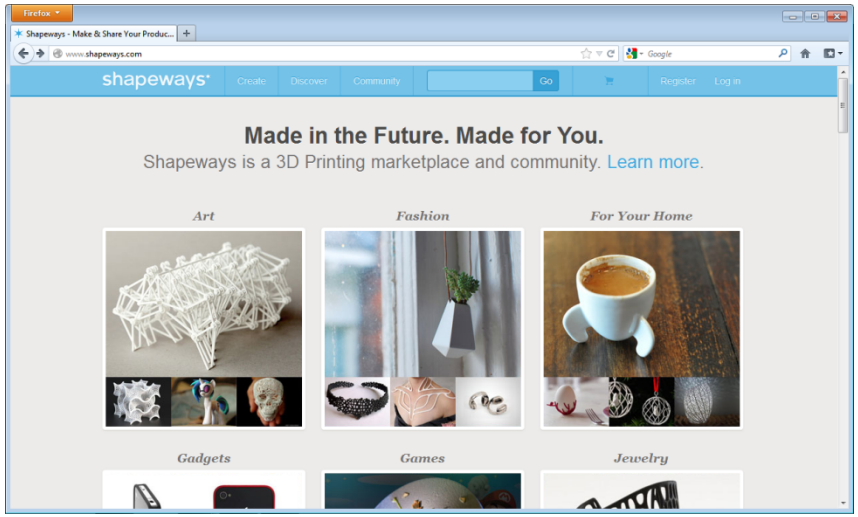
“How TechShop is changing the way hardware companies are born
By Signe Brewster Aug. 6, 2013 - 5:30 AM PDT

TechShop members get access to $1 million of equipment for $125 a month. Since the first location opened in 2006, they’ve built some amazing things. tweet this

Walk around TechShop’s San Francisco location and you feel the hum. There’s $1 million worth of equipment creating a physical hum, but also the murmuring hum of dozens of people working on making their small business a reality. […]”

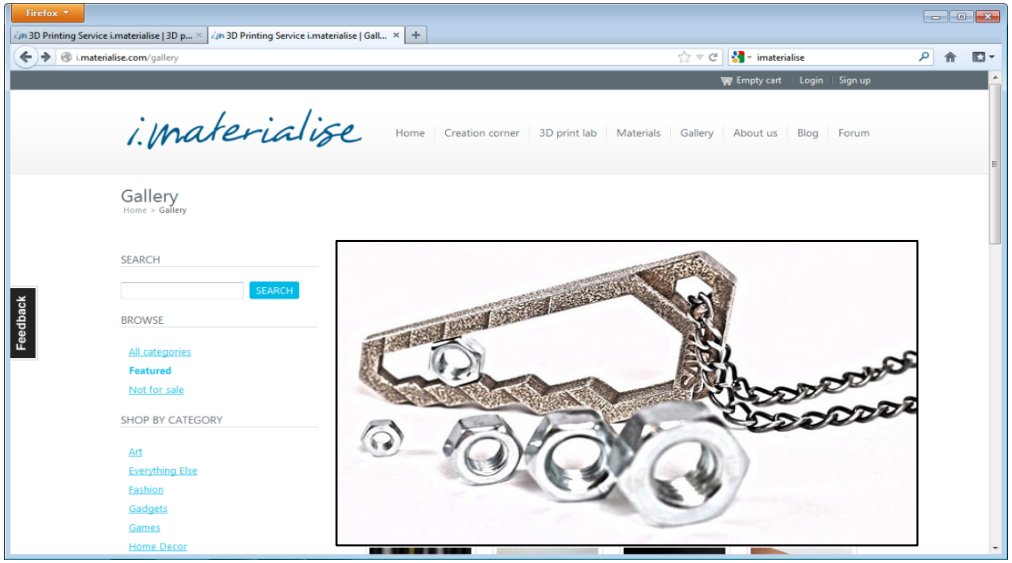
Source: http://gigaom.com/2013/08/06/how-techshop-is-changing-the-way-hardware-companies-are-born/

Limited diffusion of AM for metallic parts in digital mfg. Workshops / Fab Labs…



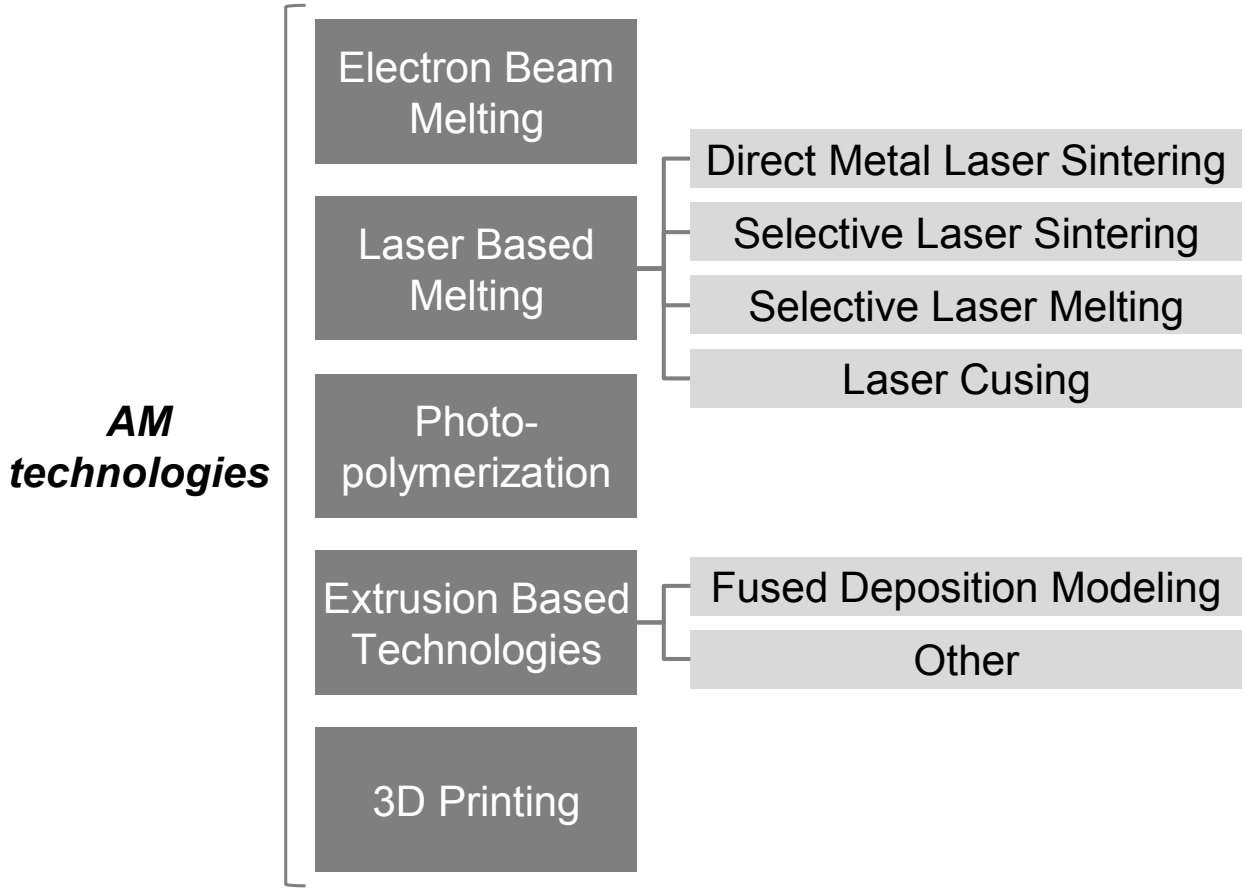
Source: Shapeways

citim



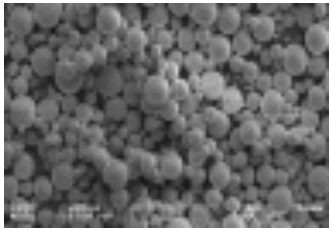
Source: Materialise, Tinkercad

Bringing digital mfg workshops / Fab Labs to the next level? —Technology landscape for 3D printing of metal parts



Selective Laser Melting, a technology for dmf. Workshops / Fab Labs?

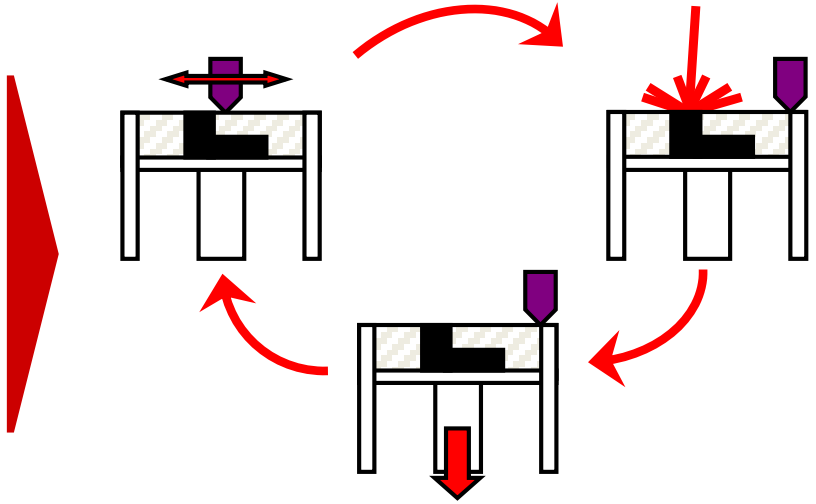
3D-CAD model
in slices



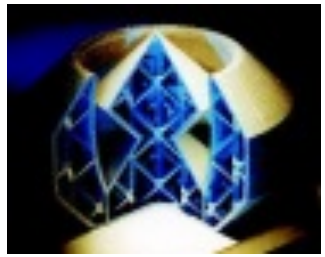
Powder

Deposition of
powder layer

Melting of
the powder

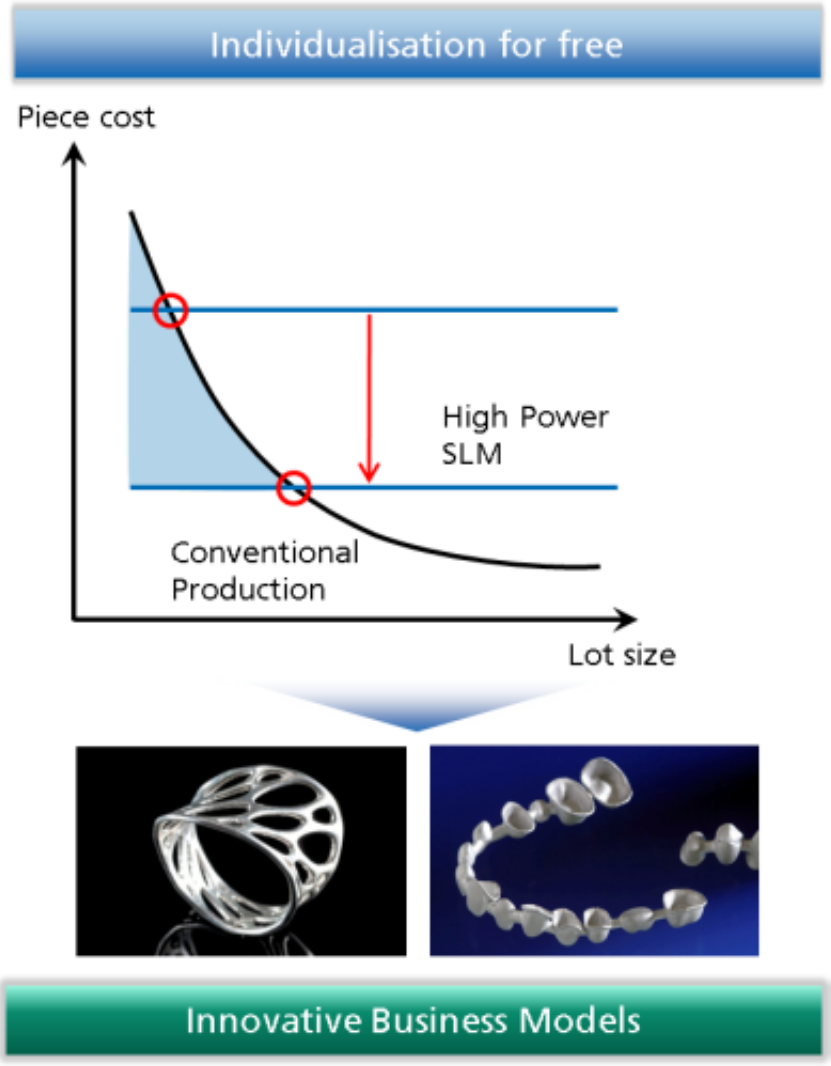


Lowering the platform

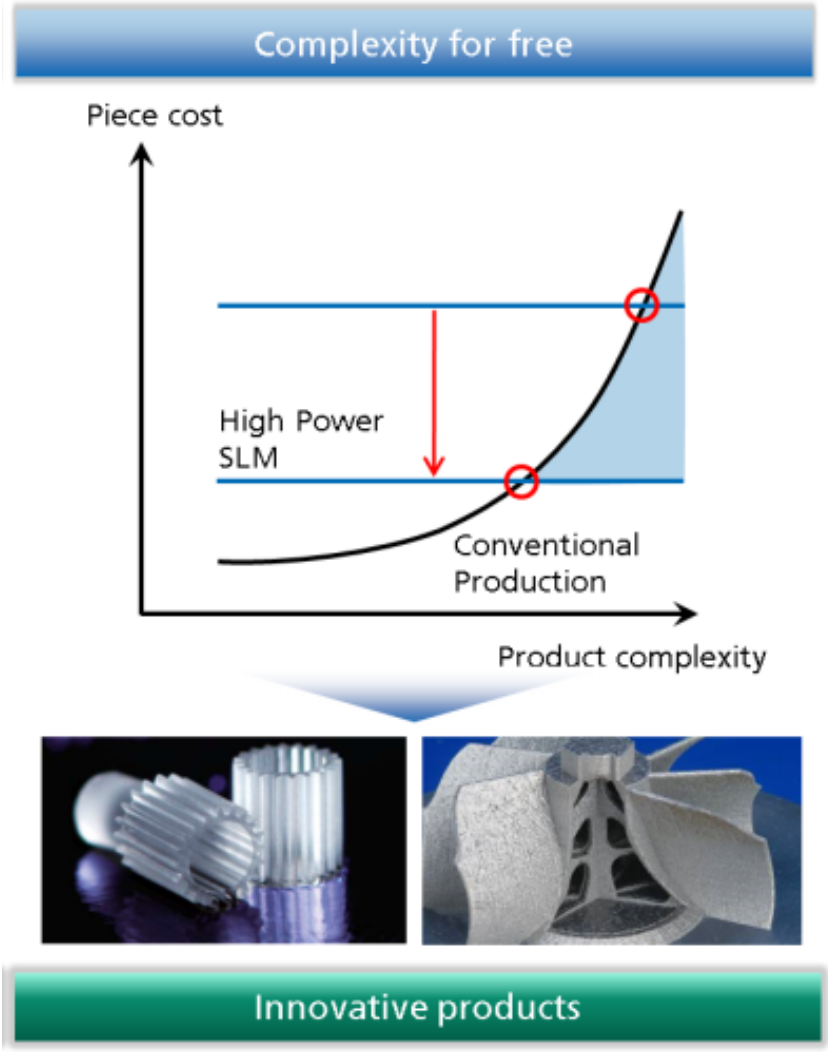


Part

Individualisation for free offers great opportunities for Fab Labs…



Complexity for free is more a opportunity for more advanced users…



Why is AM for metallic parts not used in FabLabs?

- Main differences between plastic and metallic processes
  - Machine (Investment) Costs
  - Material costs
  - Process costs
  - Design rules / guidelines
  - Process environment
  - Process know-how
  - Safety

Main drivers to boost the diffusion of AM for metallic parts…

Main hinds for AM for metallic parts are high costs and lack of know-how…

- AM is beeing hyped as a promising technology
- AM for plastic parts are common in Digital Manufacturing Workshops and FabLabs
- Main reason for the diffusion of AM for metal parts are costs and know-how

Fab Labs would be an ideal platform to foster exchange…

- Productivity, Part quality and Material Range / Design as main critical success drivers for the application in FabLabs
- FabLabs could help spreading know-how in an interaction between process experts and “makers”