Characterizing the Variety of Developments Under the Umbrella of 3D Printing

Future and Present Governance Challenges

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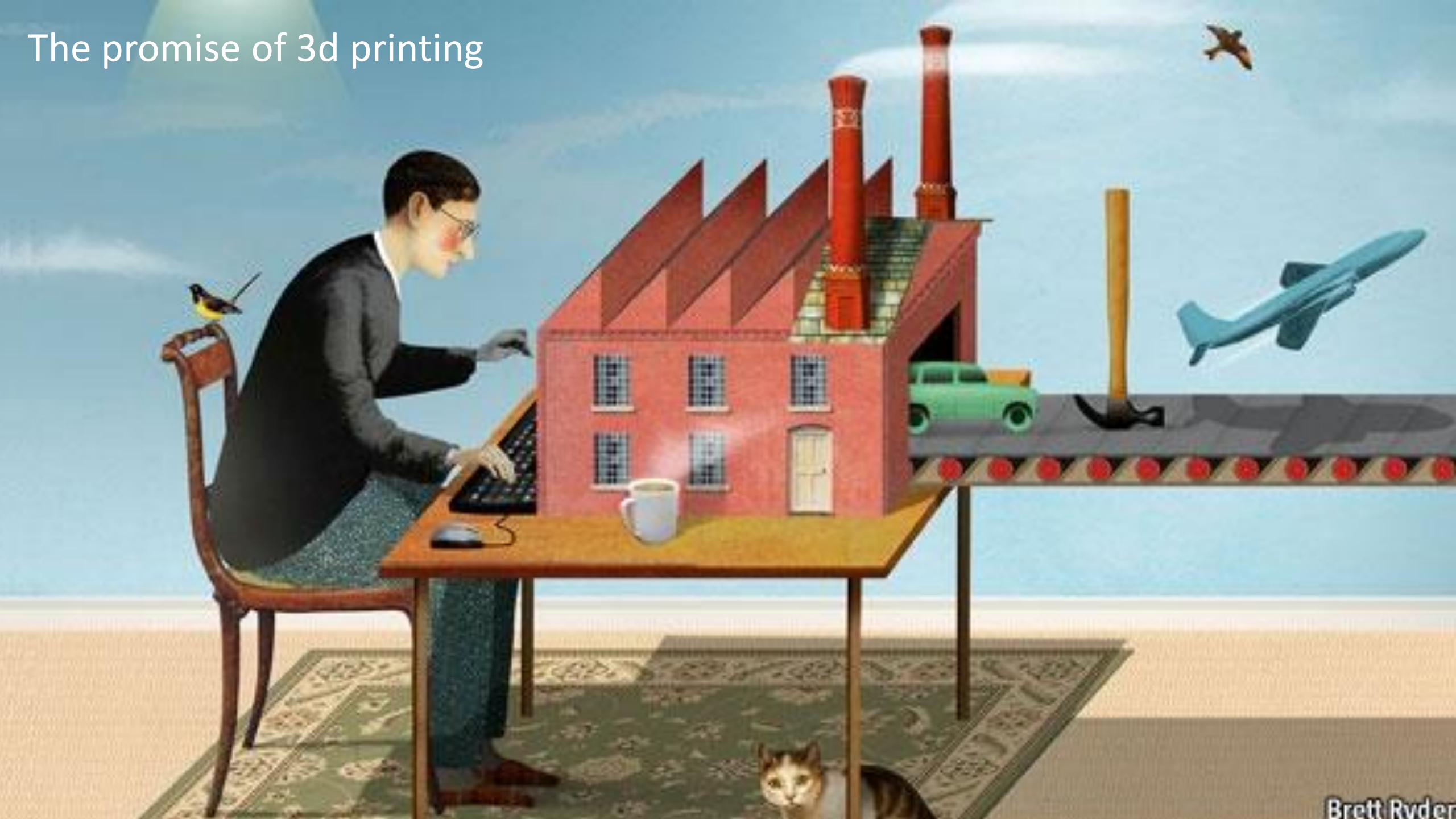
The promise of 3d printing



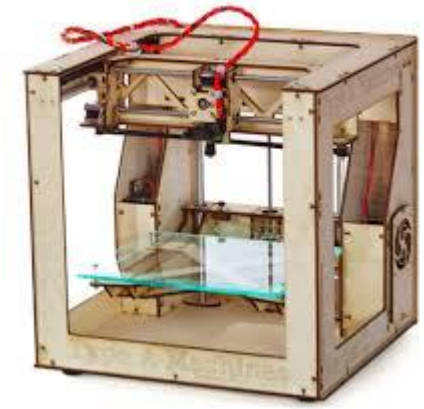
3D Printing / Additive Manufacturing

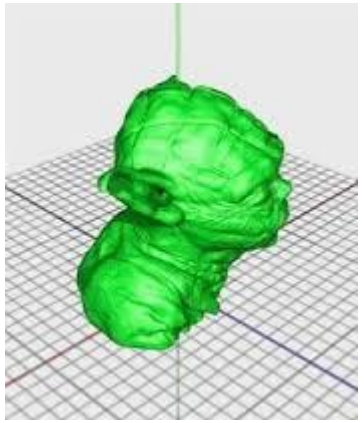
- Hype
- Hope
- Large rhetoric
- Age of everyone printing whatever they want…..

……..Not quite the case.

A 3D printer set up

- A 3D printer activity is made up of four elements
- The triad of printer / material / design file
- And the product that is being produced

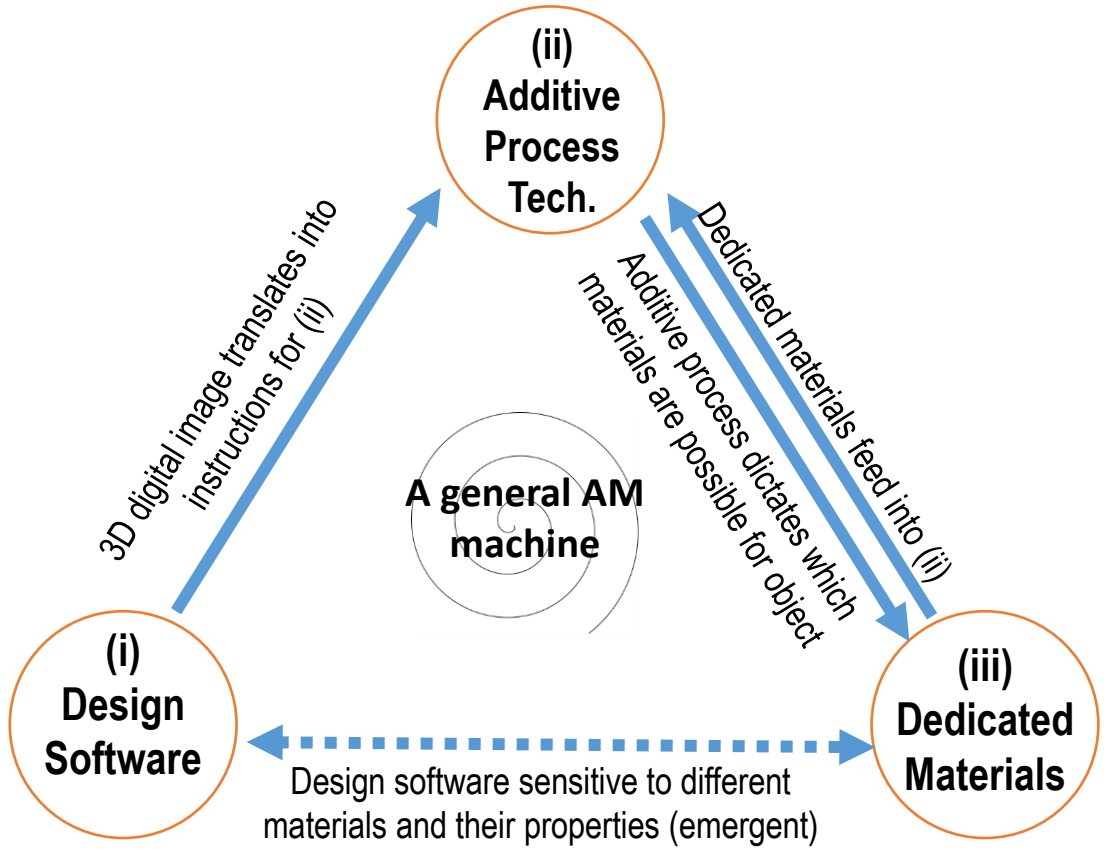




A dominant design : a tripartite schema

- A 3D printer activity is made up of four elements
- The triad of printer / material / design file

A dominant design!



But what is the stage of maturation?

Is there a market? And what does it look like?

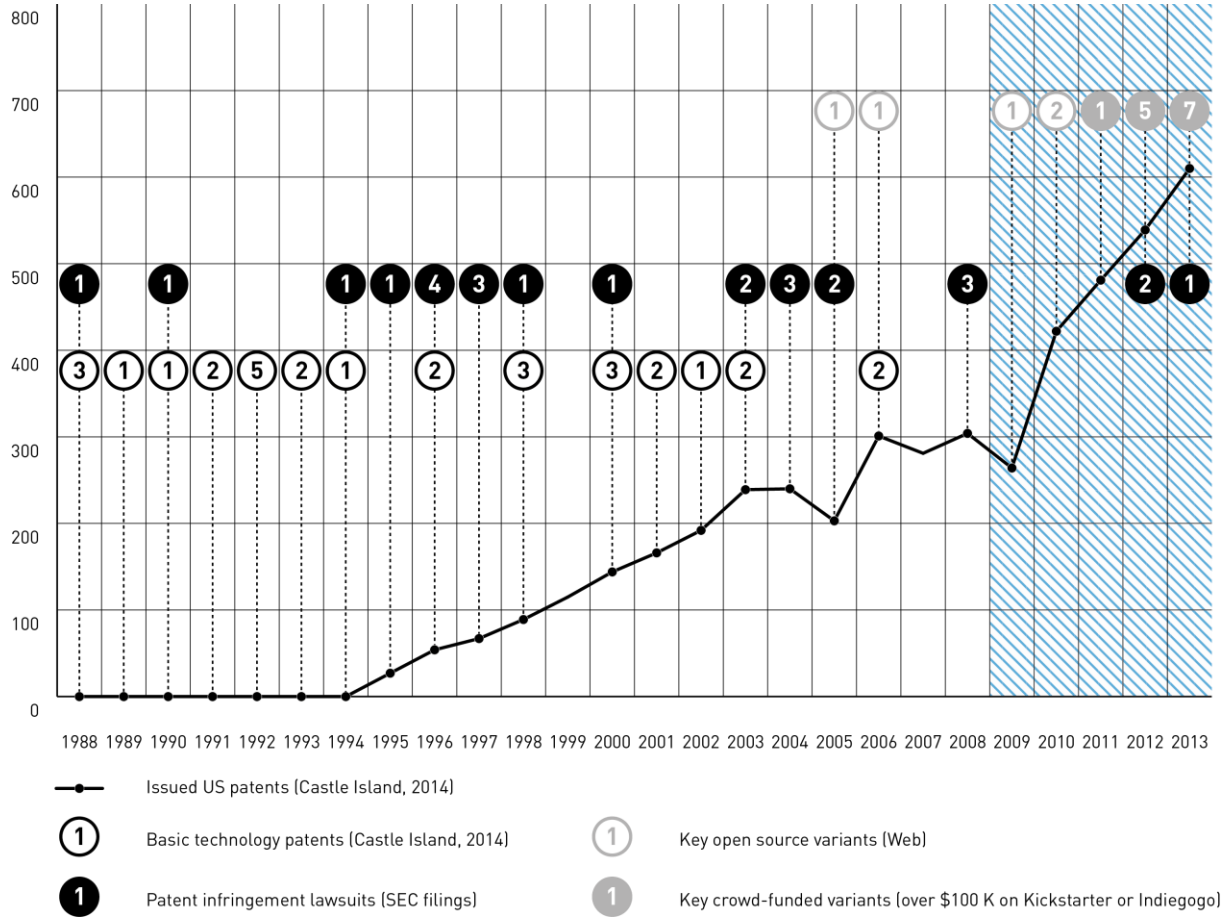


Figure A: Key patents overlaid on issued US patents for Additive Manufacturing.

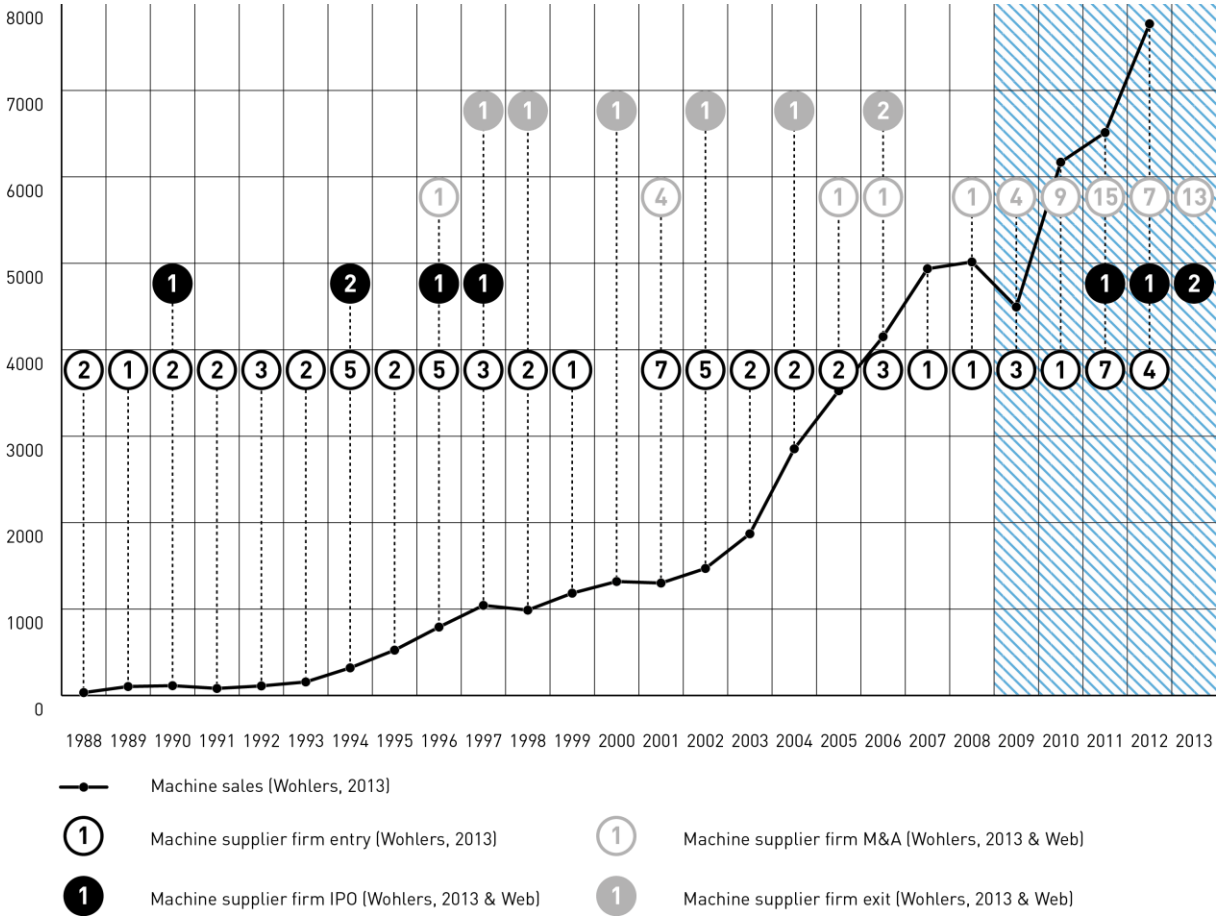
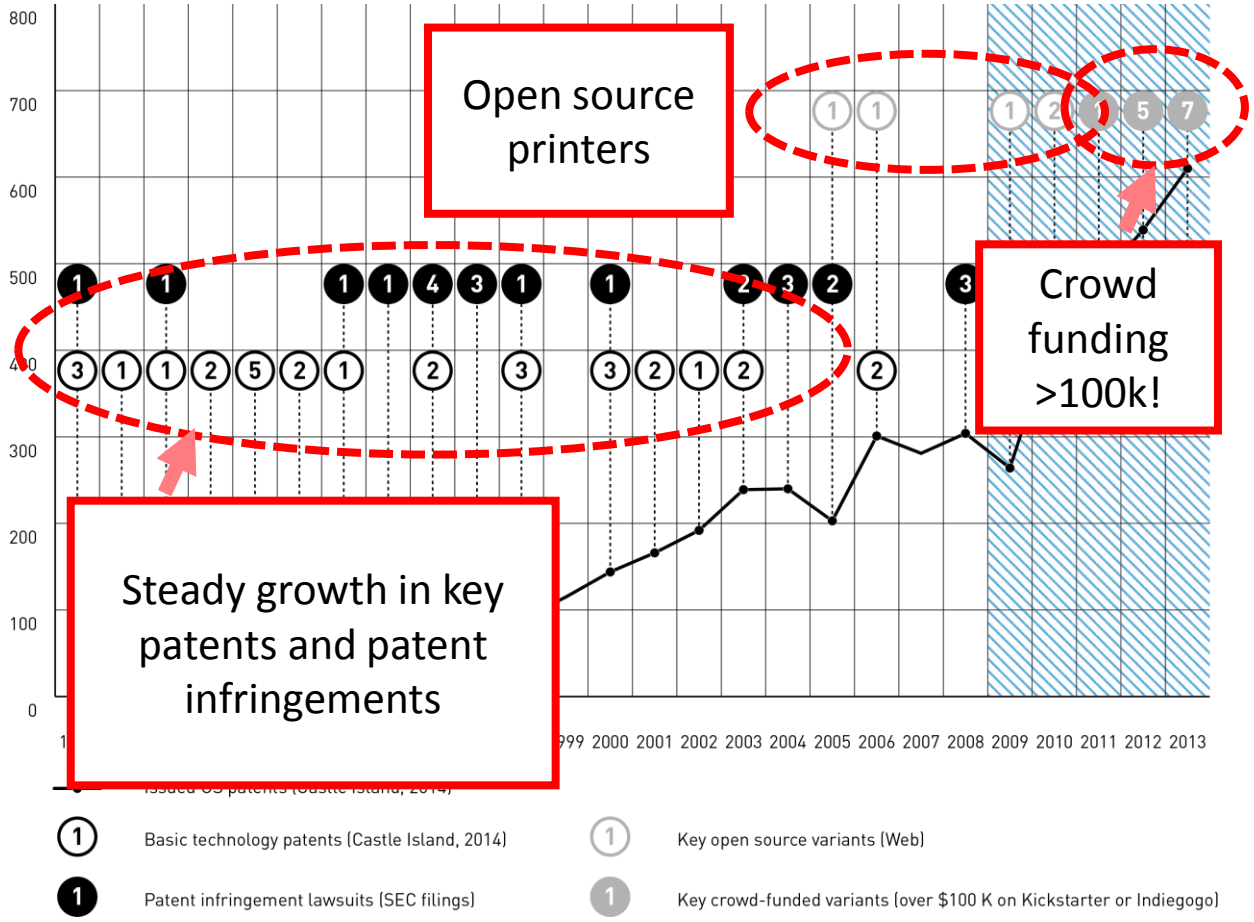


Figure B: The growth in number of **machine supplier firms** overlaid on yearly machine sales



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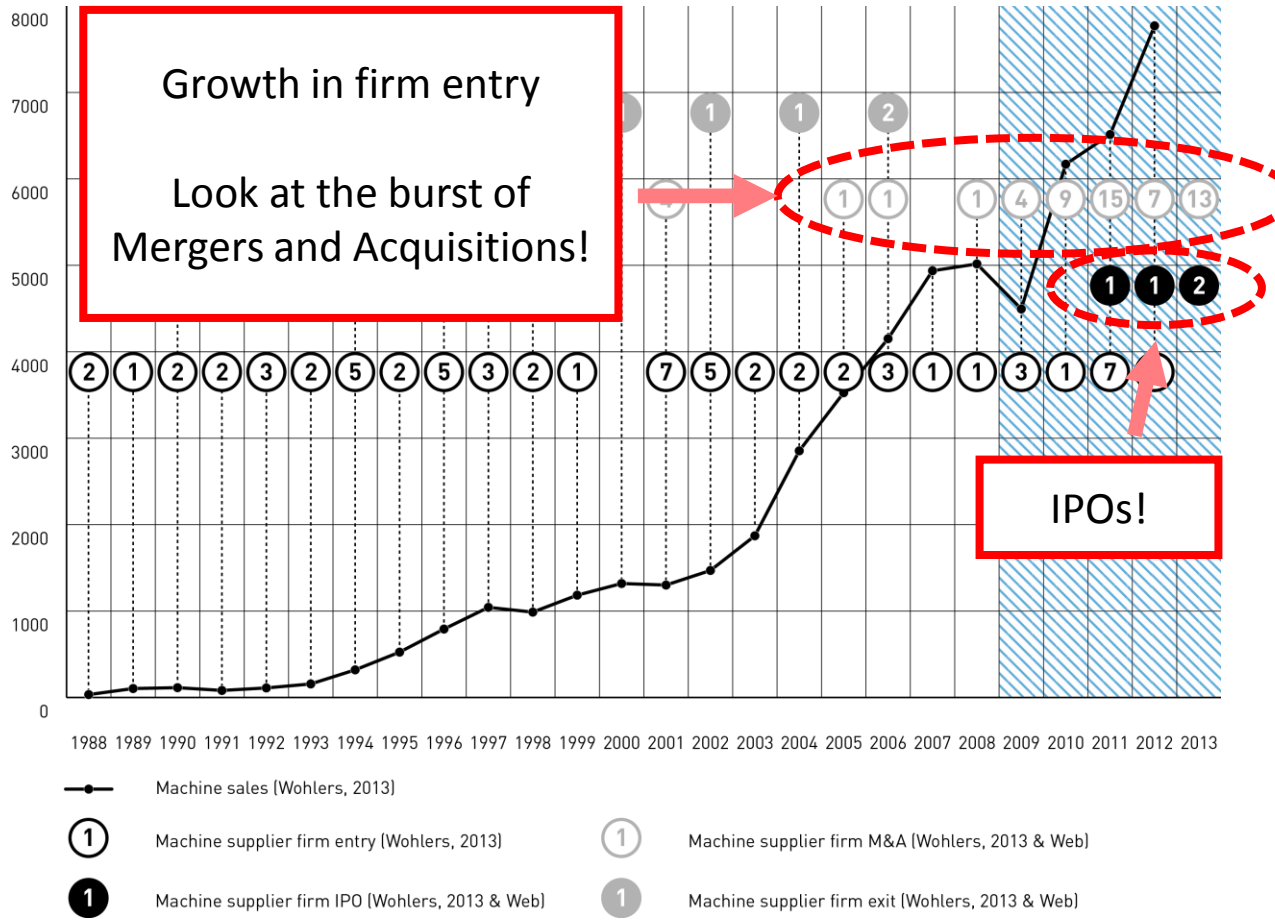

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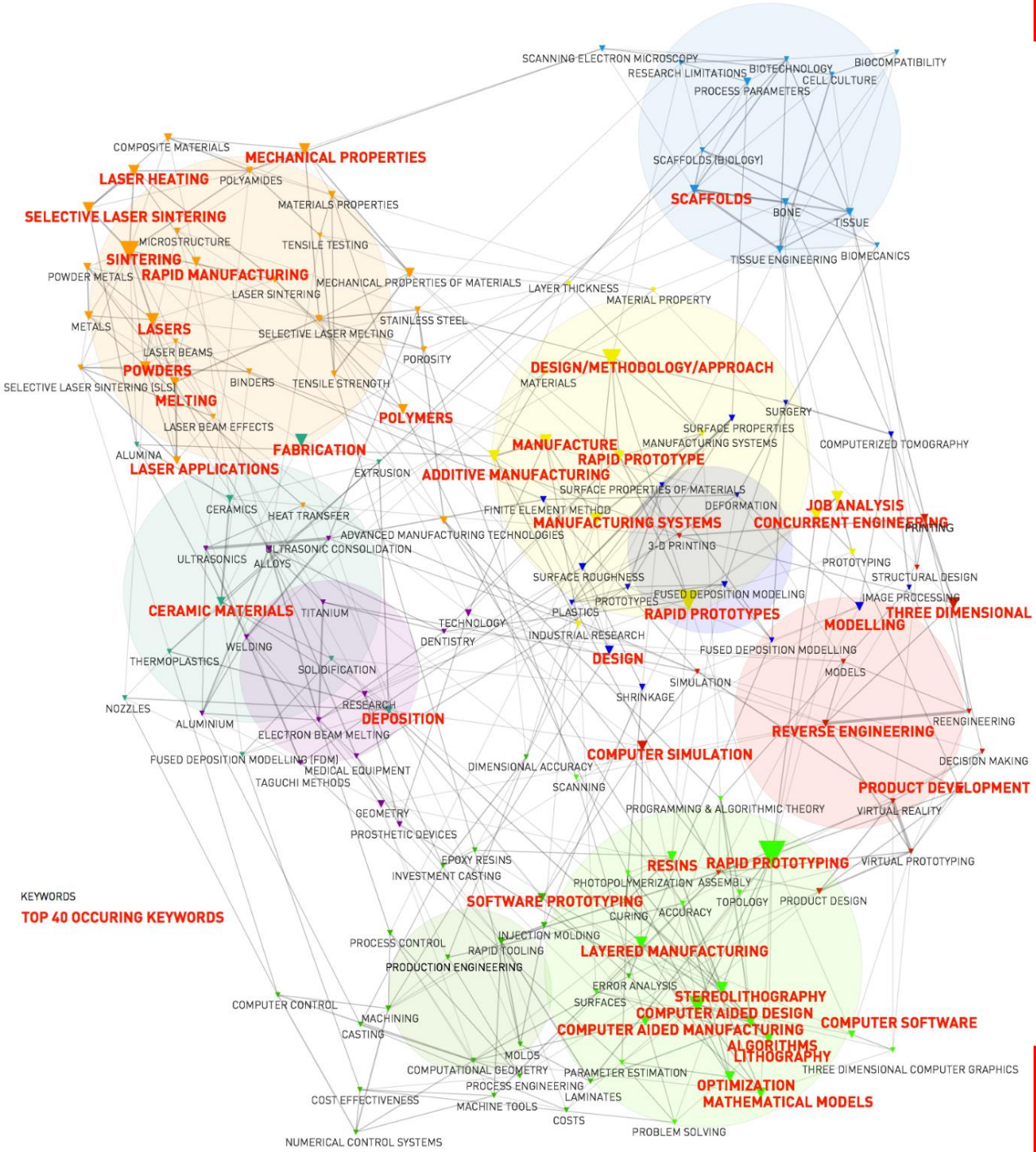
So a maturing supply of printers, but what about use?

A search in the web of Science reveals clusters of themes of research and development.

Many BEYOND rapid prototyping. New capabilities and new knowledge



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A focus on
Manufacturing

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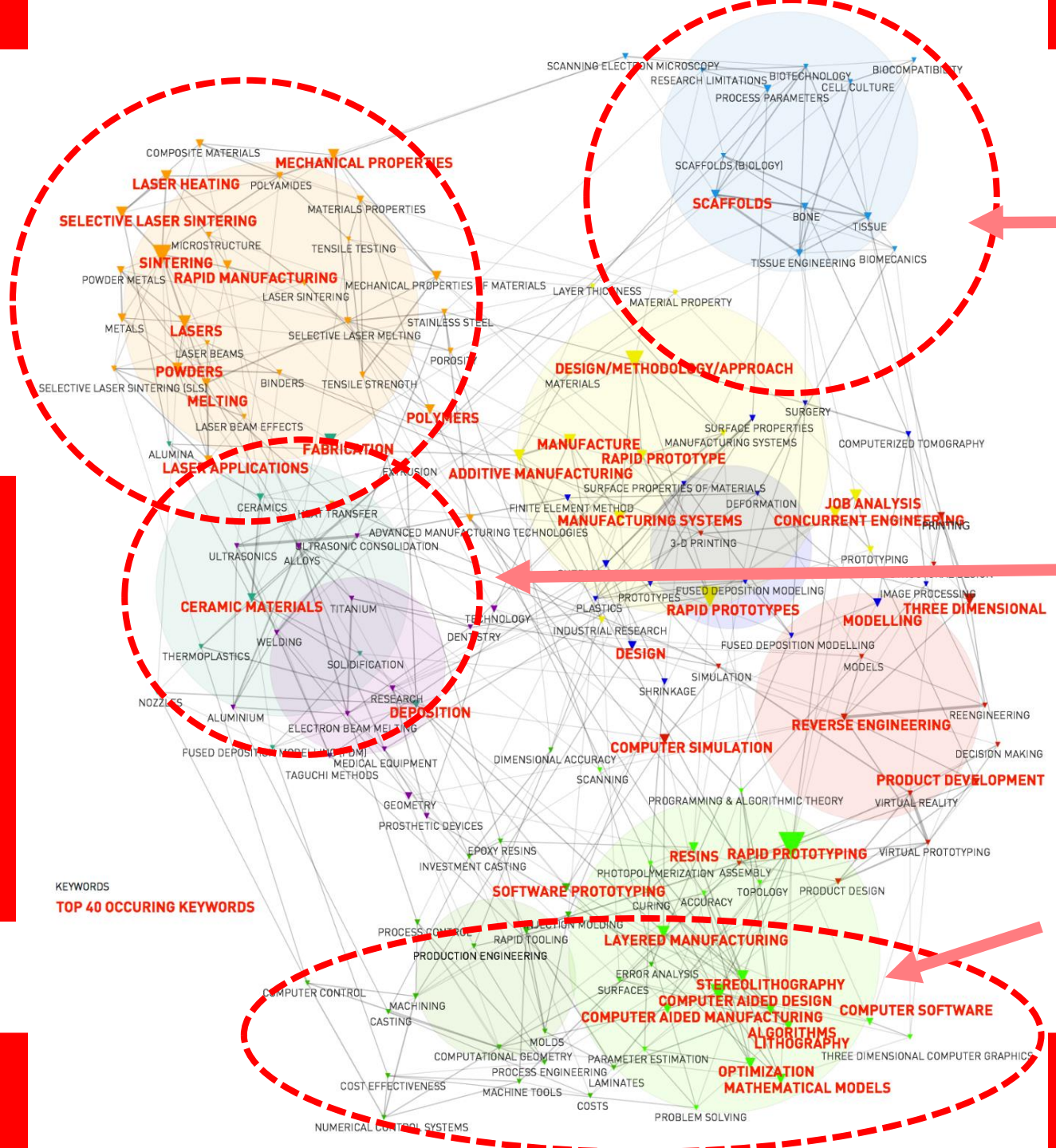

Advanced in **biomedical** materials and applications

New materials like **Ceramics**

Advances in **Automation & Computation**

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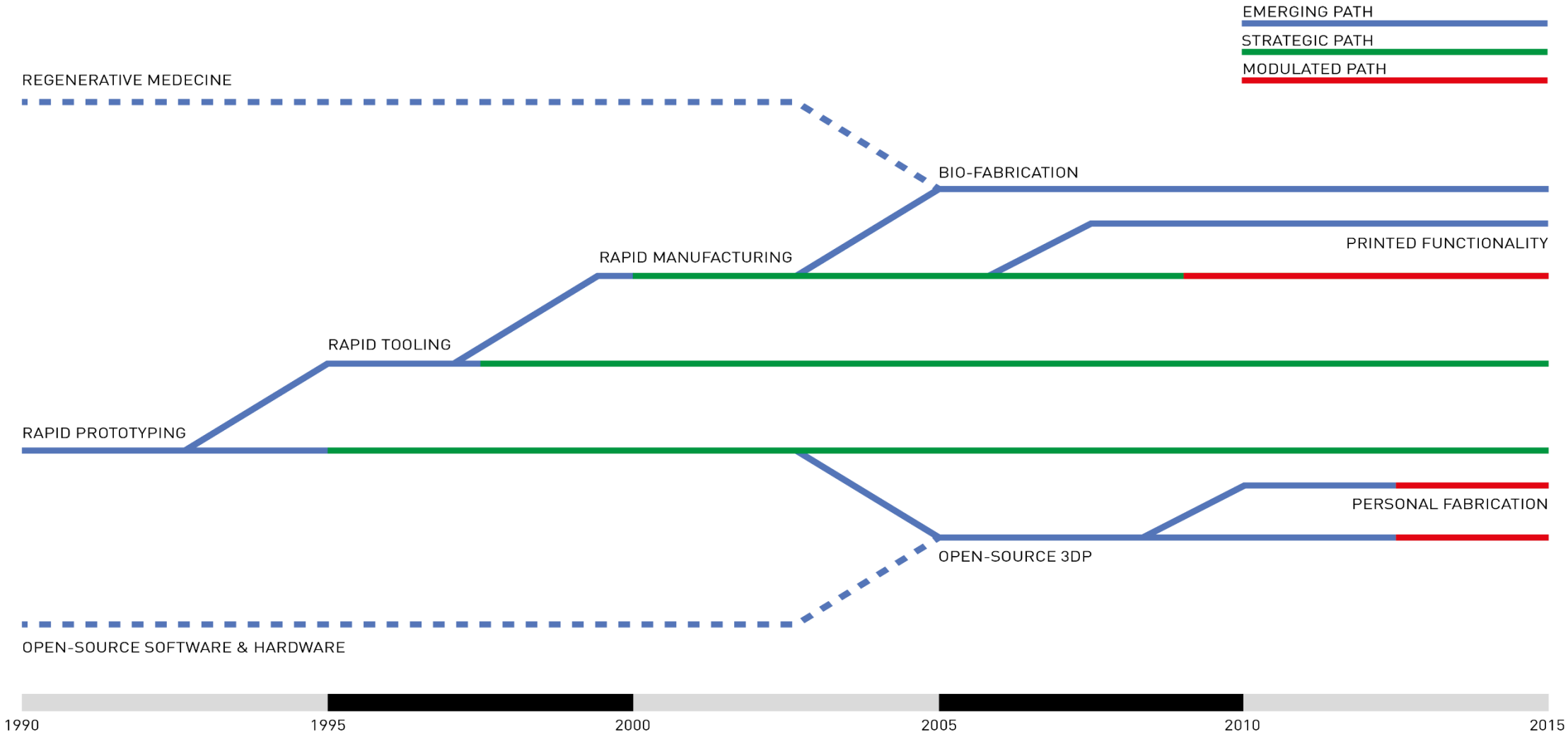
3D printing branching

Branching into ?

The triad evolving in different paths



A number of innovation pathways (visible today)

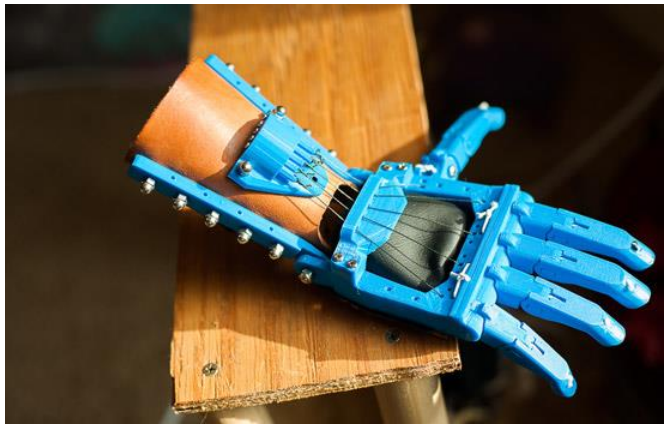
- Rapid prototyping expanding into DIY community, hobbyists and makers
- Artisan additive manufacturing (jewellery, dentistry, fashion)
- Advanced additive manufacturing focused on new shapes and new material mixes (automotive, aerospace, energy sector)
- Biomedical prosthetics (printed external prosthetics, implants, bones and skull parts)
- Printed tissues and bioprinting (printed tissues for)

Current embedding scenarios in medical area

3D printed skull

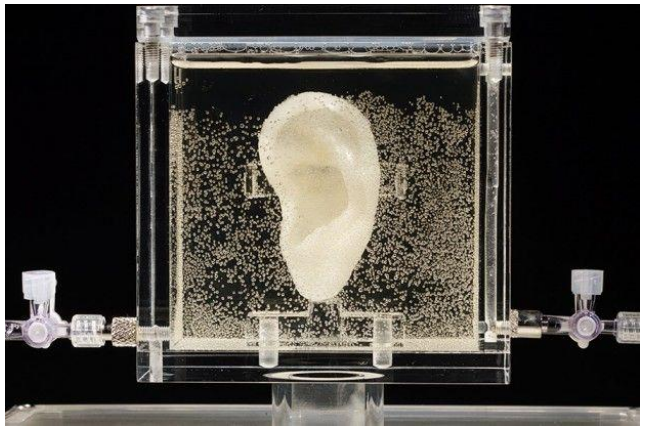
This case distributed across three regulatory zones

DIY Prosthetics



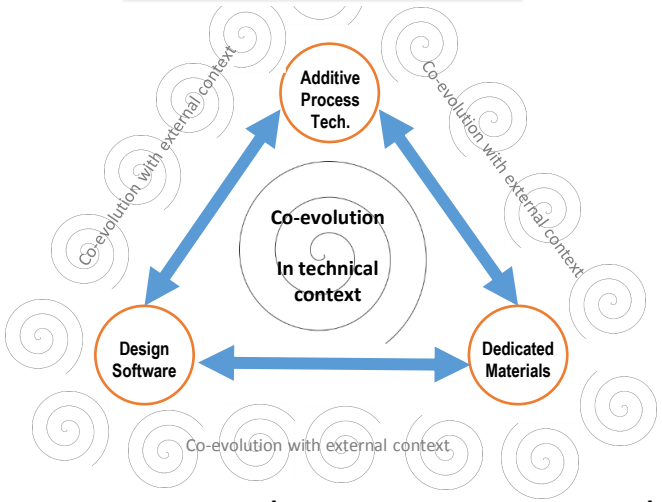
Open source and affordable but with quality and safety issues

Printed tissues

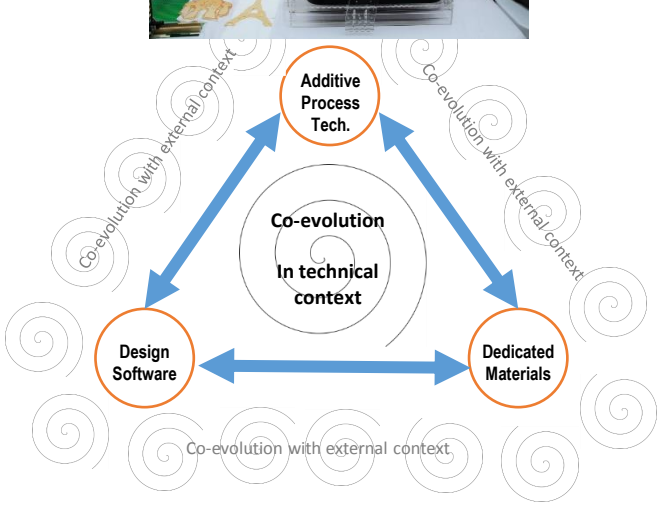


Emergent but maturing. Early apps as tissues for screening

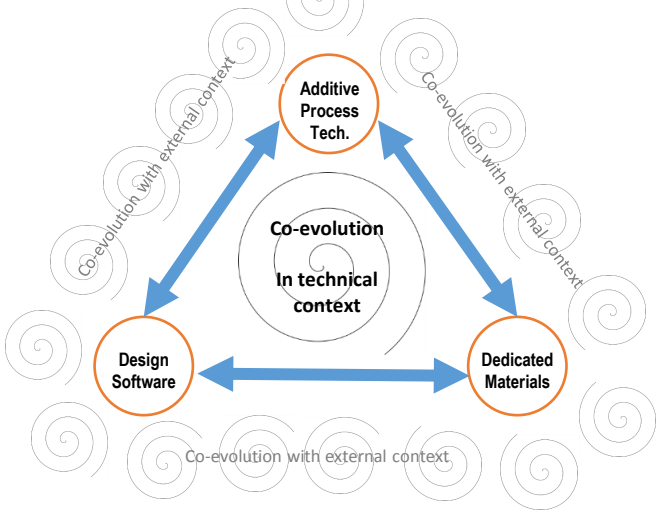
Different knowledge and elements that fit in the triad : Different supply chains!



Stem cells / printer standards / hospital setting?



Easy access to materials, digital files, distributed use by untrained users



High end materials, advanced imaging and computation, high standards

Ongoing work

- Article on the different pathways accepted for Technology Forecasting and Social Change (with some revisions).

- Governance questions coming from the different supply chains for each pathway

- Embedding Scenarios : AMT uses and their impacts

Want to talk further or partner?

contact@douglas-robinson.com

Key Reference: Robinson D.K.R. and Lagnau A. (Forthcoming) Innovation Pathways in Additive Manufacturing: Comparing budding and branching paths from rapid prototyping to alternative applications in science and markets. Accepted with revisions for *Technological Forecasting and Social Change*