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New services:

→ lots of innovation with business models.

⇒ Lots of innovative business models fail! $10s of billions, probably $100s of billions if you go back to the dot.com boom.

- winner-take-all mindset: innovation may not add much value, but it's financially valuable if it is sufficiently better that it can displace an incumbent.
- is this good for society? if we are wearing our economist hat, we shouldn't be too quick to laud Silicon Valley.
- ICOs an example

More on Netflix:

- it really is a crowded field.
- how vary from other players? not clear. yet.
  - • will the Disney revenue stream be solely subscriptions?
  - • Amazon puts for-sale content (pay to view, DVD purchase etc) alongside Prime Video. they also have advertising. and subscription fees. so three revenue streams, not just one

Systems of innovation

- public good ⟵⟶ government support.
  - • more considered in EU
  - • piggybacks on DoD and nuclear power (DoE) in the US
- national labs: ORNL. basic research, but also applied at the far end from commercial. bring tech to where it can be commercialized, license others to actually do so.
  - • DARPA but not fully open to scrutiny
  - • DOE does systematic evaluations, you can download the external reviewer reports (and thereby get a summary of interim results)
- joint research consortia. need antitrust exemption.
  - • those in Japan haven't worked well, not much cooperation
  - • agreeing on what to do … not so easy
- extension services
  - • especially for SMEs (plastic printing now much lower in cost, so not focus)

    3D printing in Portugal: tool-and-die industry (plastic injection molding)

    structuring to finesse EU funding that (for obvious reasons) tries to avoid being captured to the benefit of just one member country

    3D metal printing still new, capital costs ($1 mil) far beyond budget of a small firm that wants to learn what's possible

    so creating outreach program where a machine (plus associated expertise, such as it is) is made available can give feedback to machine manufacturers and let SMEs evaluate and (if successful) carry out small one-off projects: aim is to be more than a toy

Universities: public good challenge: why should a state government fund R&D that might be used by a firm in Brazil or Norway, or even the next state over?

= answer: they shouldn't!! and indeed public R&D funding in the US is down about 50%

= meanwhile China 2025…goal global leadership in select industries. now with Trump threats to global supply chains, renewed priority as national security not international prestige

- lots of work, healthcare, pharmaceuticals. tensions that government funding can end up used for projects with substantial private gains, such as Google's search engine.

Back to sources:

- users of technology: famous study by von Tunzelman on scientific equipment: origin may be a piece of equipment developed by a PhD, but commercialization requires discovering and exploiting market. for what do purchasers use it? which features do/don't matter? wish list of capabilities!

- automotive roadmapping process overlaps in that to-and-fro over direction and content of R&D.

But what to develop

- casual observation that funding is trendy, and subject to political demagoguery

» Congressional attacks on research on honeybees. Apparently they never had Biology 101 to understand that between the birds and the bees, it's the bees that matter for agriculture, while the birds are pests.

- we can each develop our own list. epidemiology would be high on mine, including work on antibiotic resistance: bugs evolve really fast, while we've not discovered a new class of antibiotics in (to my knowledge) 2 decades.