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« Innovation and employment:
cornerstones of the energy transition »

Energy transition beyond market and planning: the critical issue of cooperative architectures for innovative design

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théorie et méthodes de la conception innovante

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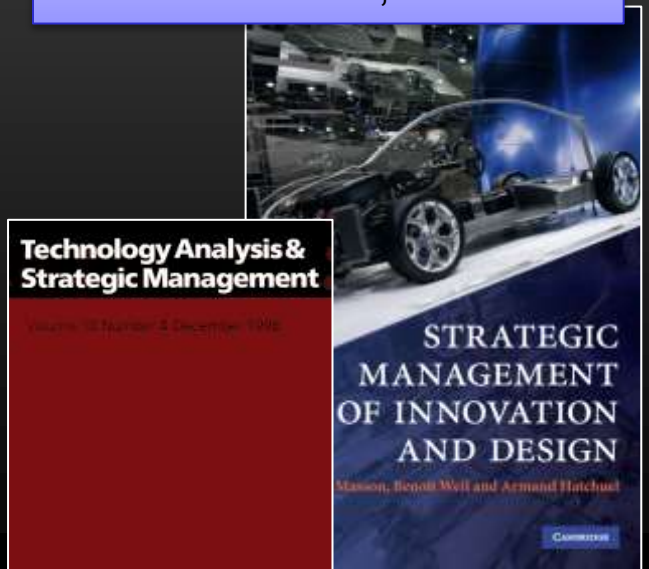
Management Science

- IPDM conference, CIM community, EURAM,…
- JPIM, TASM, CIM, RADMA,…

Engineering Design

- ICED, Design Society, SIG Design Theory…
- RED, JED, CIRP,…



Sources

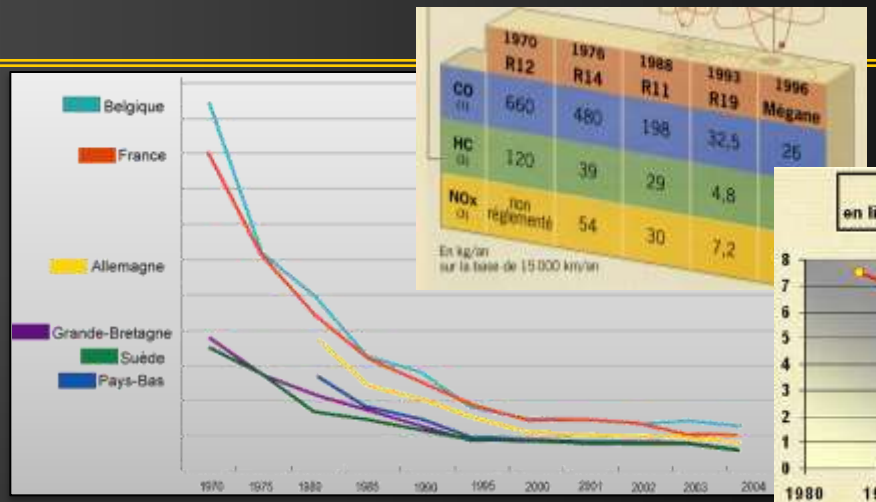
- Research program on design regimes (French National Research Agency – ANR)
- Papers:
  - **Agogué, M., Le Masson, P., et Robinson, D. K. R. (2012)**. “Orphan Innovation, or when path-creation goes stale: missing entrepreneurs or missing innovation?” *Technology Analysis & Strategic Management*, 24, (6), pp. 603-616.
  - **Le Masson, P., Weil, B., Hatchuel, A., et Cogez, P. (2012)**. “Why aren’t they locked in waiting games? Unlocking rules and the ecology of concepts in the semiconductor industry. .” *Technology Analysis & Strategic Management*, 24, (6), pp. 617-630.
  - **Robinson, D. K. R., Le Masson, P., et Weil, B. (2012)**. “Waiting Games: innovation impasses in situations of high uncertainty.” *Technology Analysis & Strategic Management*, 24, (6), pp. 543-548.
  - **Agogué, M., Yström, A., et Le Masson, P. (2013)**. “Rethinking the Role of Intermediaries as an architect o f collective exploration and creation fo knowledge in open innovation.” *International Journal of Innovation Management*, 17, (2), pp. 24.

Energy transition, beyond market and planning: cooperative architectures for innovative design

1. Characterizing the transition challenge: **shaping the unknown**
2. A paradigm shift in collective action: **from decision-making to innovative design**
3. Consequences: new firms and ecosystems organizations – **cooperative architectures**
4. Conclusion: public policies in transition – from « incentives » policy to « capacity » policy

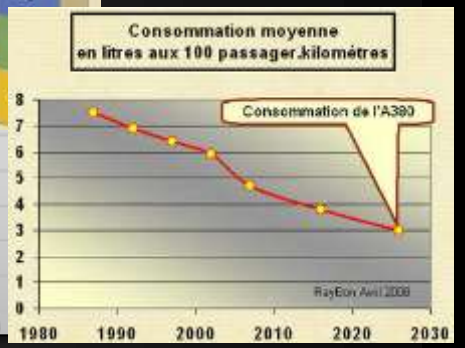
Contemporary innovation: from planning and optimizing to…

- Stabilized valued, continuous improvement of performance
- Stabilized competences – technical schools, R-labs,…
- Industrial « filières »
- Value-chain (intégrator, OEM, 1st tiers suppliers, 2nd tiers…)



	1970 R12	1976 R14	1988 R11	1993 R19	1996 Mégane
CO	660	480	198	32,5	25
HC	120	39	29	4,8	
NOx	non réglementé	54	30	7,2	

En kg/an sur la base de 15 000 km/an



Aéronautic

Household applicances

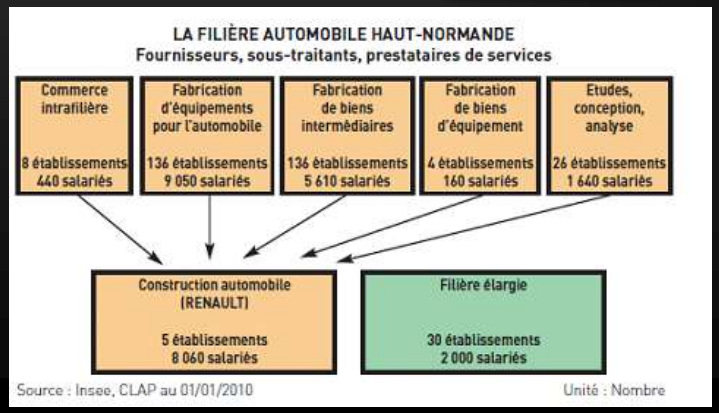
Railways

Electronic

Automotive

Nuclear

Agronomic



Contemporary innovation: from planning and optimizing to… shaping the unknown

- Changing the identity of objects (conceptual breakthrough)
- Rule breaking / creation of new competences (tech & sciences)
- Rejuvenation / creation of industries
- Collaborative design: alliances, platforms, communities and consortia for innovation

The house as a powerstation?

Hybrid car

Autolib'

Metronizar o omnibus

Cloud computing, internet of things…

Lab-on-a-chip

Smart Grids

Home networking

Smart cities

Biomass

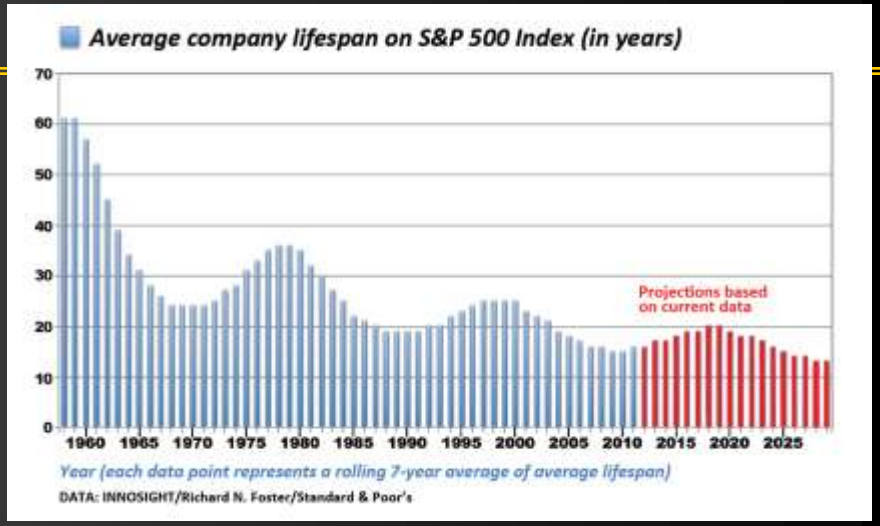
intel Leap ahead

Intel Architecture Lab (Gawer et al)

ITRS (International Technology Roadmap for Semiconductor ind.)

Critical issues for expansion

- **Fragile giants…**
- **(Innovation) bubbles** – hype and disappointment
- **Limited success of incubators and start-ups**
- **Unsuccessful, costly innovations**
- **Orphan innovations (Agogué 2012)**
- **Forever technologies of the future**



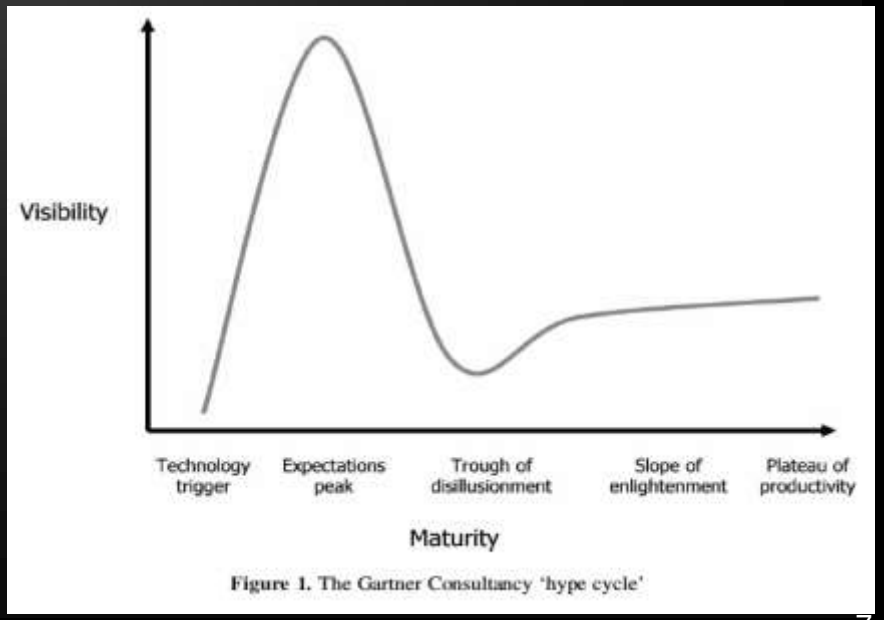
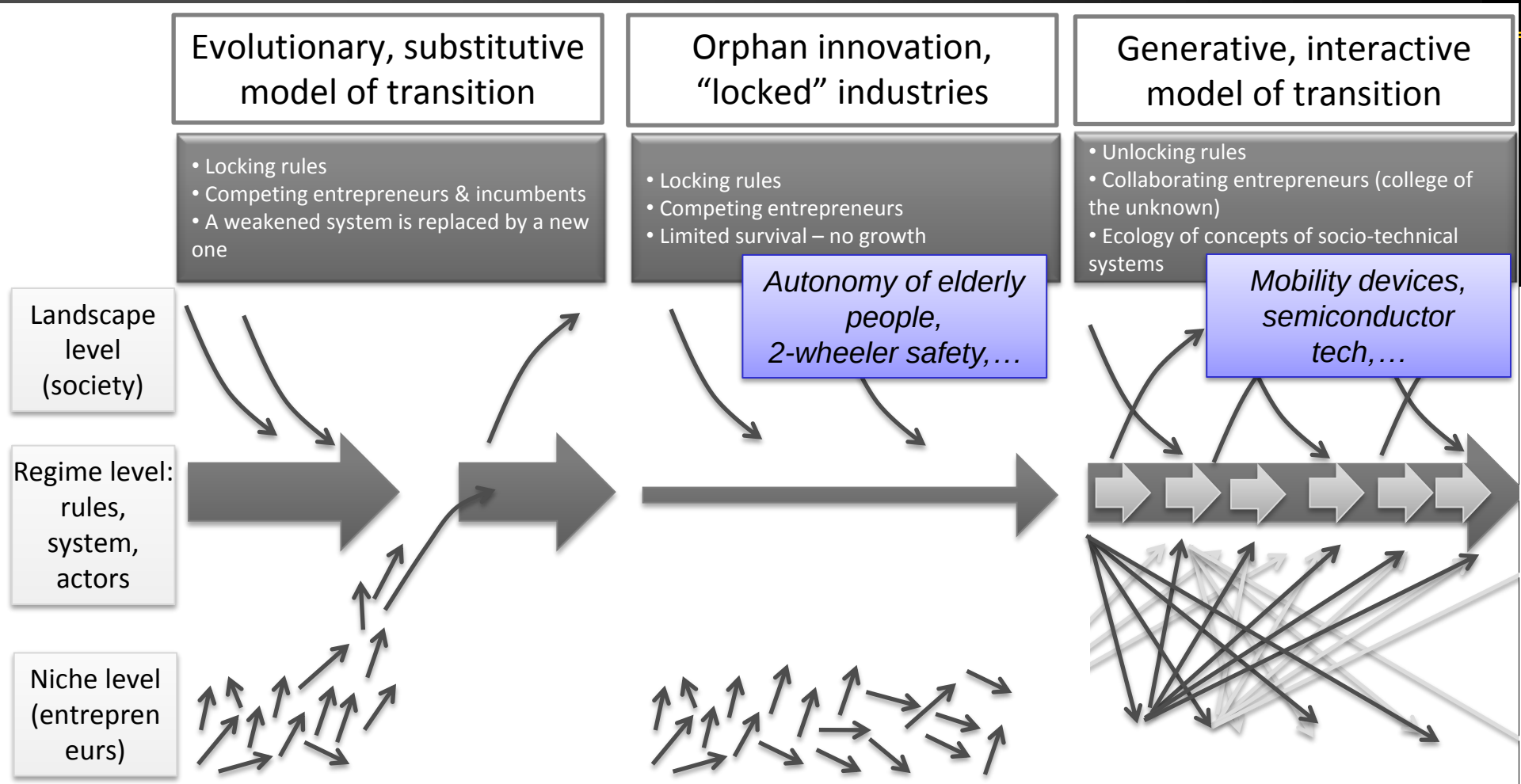


Figure 1. The Gartner Consultancy 'hype cycle'

Regime transition? Not only one trajectory…



Neither market, nor planning warranty one trajectory…
How can we *manage* transition? Collectively?

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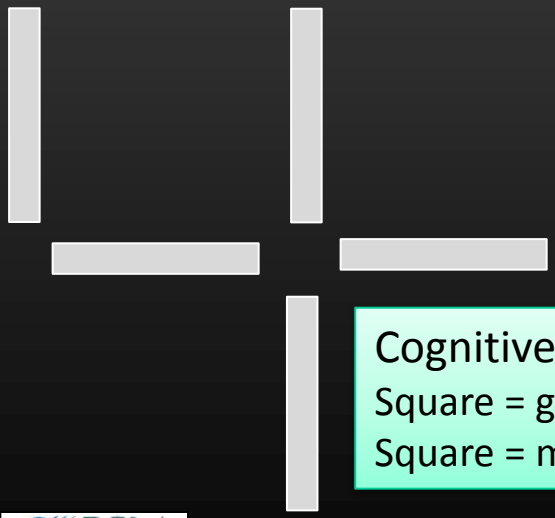
Cognitive obstacles to collective expansion

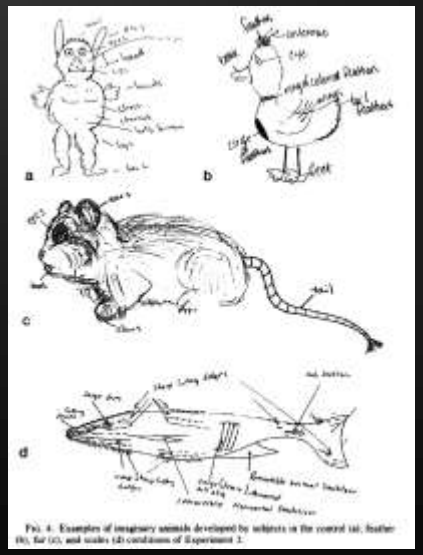
- Open innovation, co-design, brainstorming, living lab…
- Is it efficient?

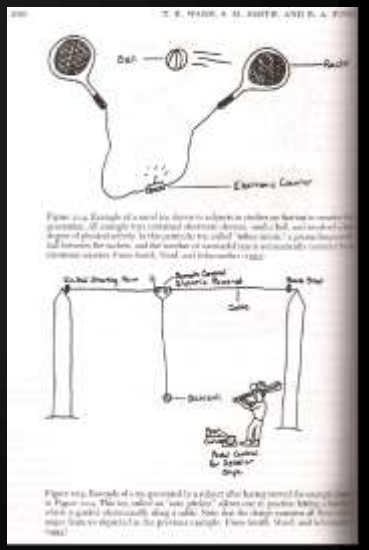
A « productivity gap » phenomenon in brainstorming !
Individual and collective cognitive causes



How to make a square by moving ONE match?

Cognitive fixation on « square » :
Square = geometrical shape
Square = mathematical operation (2x2)

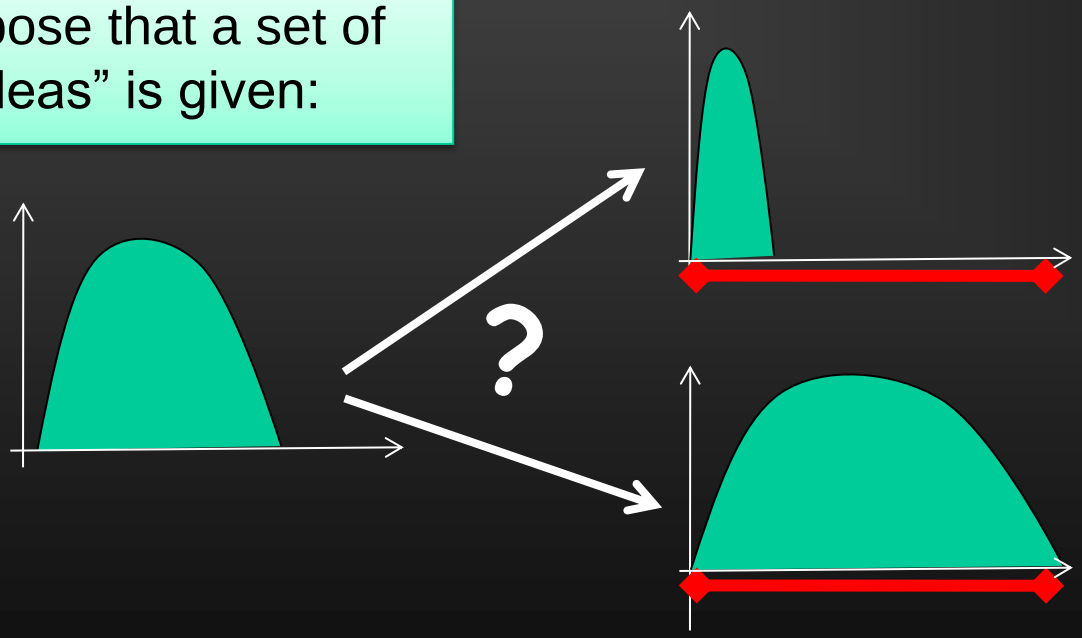




A paradigm shift in collective action: from decision making to design

In the 50s : optimization capacity? → decision theory.
Today : expansion capacity? → design theory

Suppose that a set of "ideas" is given:



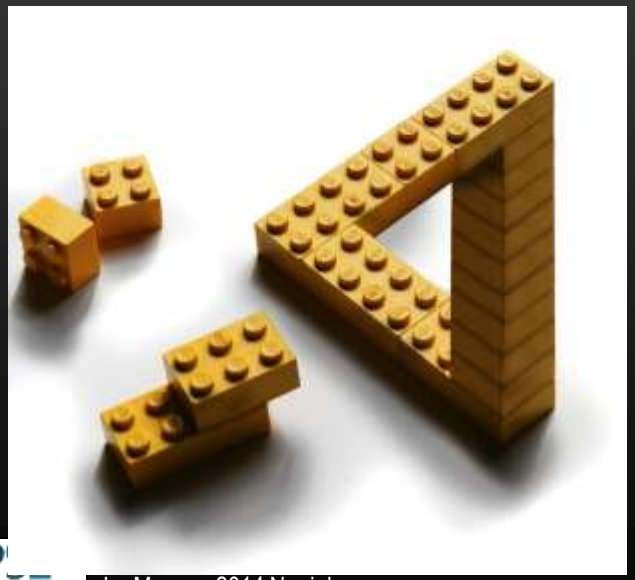
Is there a bias? How to measure it?

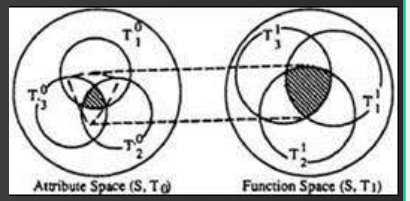
If there is a bias, what are the causes?

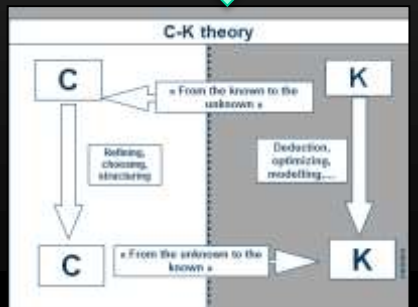
How can one overcome the bias?

« Models of thought » : new design theories for expansive reasoning

Hatchuel, Le Masson, Reich and Weil 2011 ICED (reviewers favorite)







General design theory (Yoshikawa 1981)

Axiomatic Design (Suh 1988)

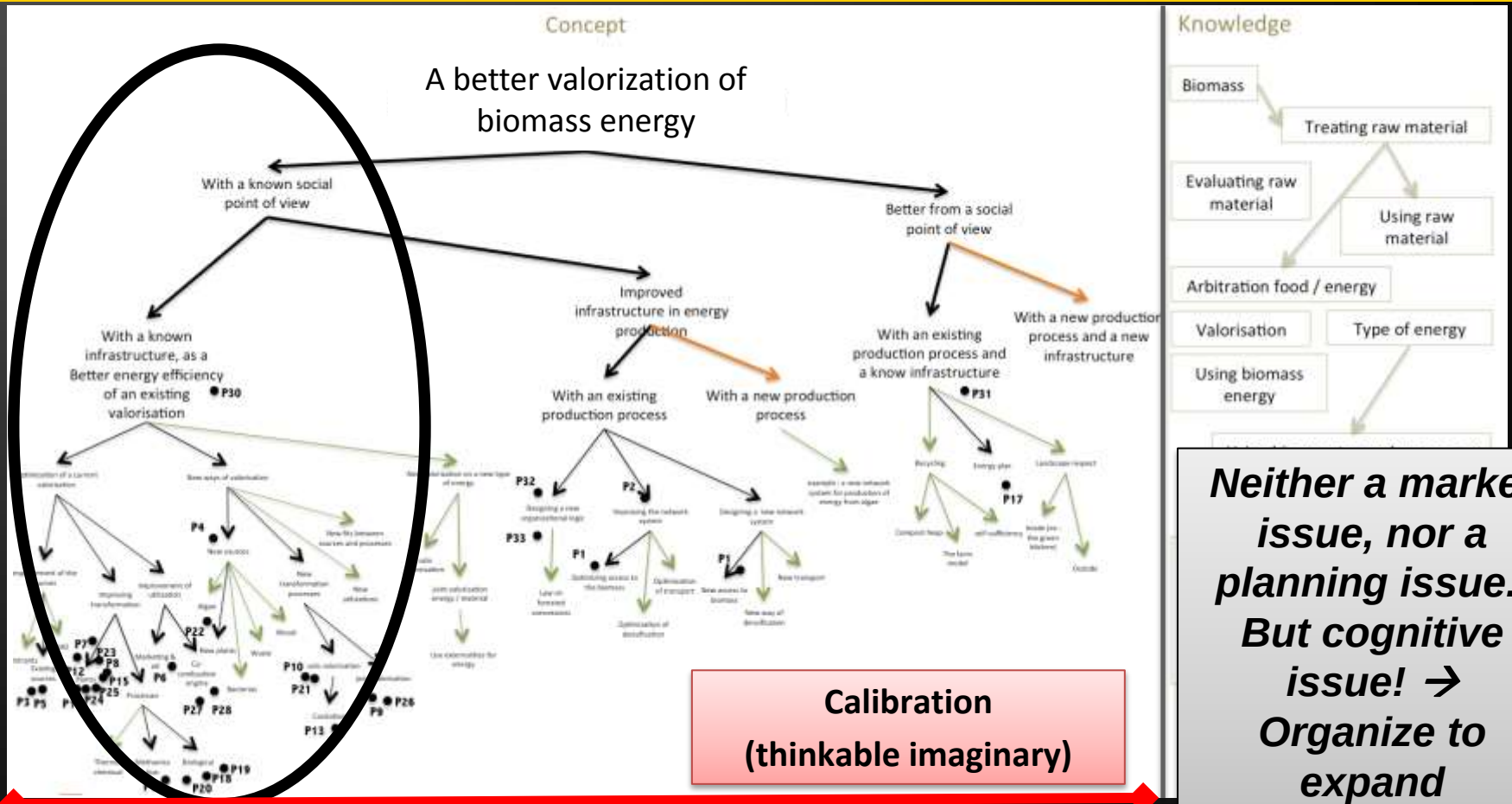
Coupled design Process (Braha & Reich 2001)

Infused Design (Reich & Shai 2001)

C-K theory (Hatchuel & Weil 2002)

Agogué et al. 2012)

One example: identify fixations in biomass enery with C-K theory



Calibration (thinkable imaginary)

Neither a market issue, nor a planning issue.. But cognitive issue! → Organize to expand collectively?

Restrictive reasoning (optimization)

Expansive reasoning

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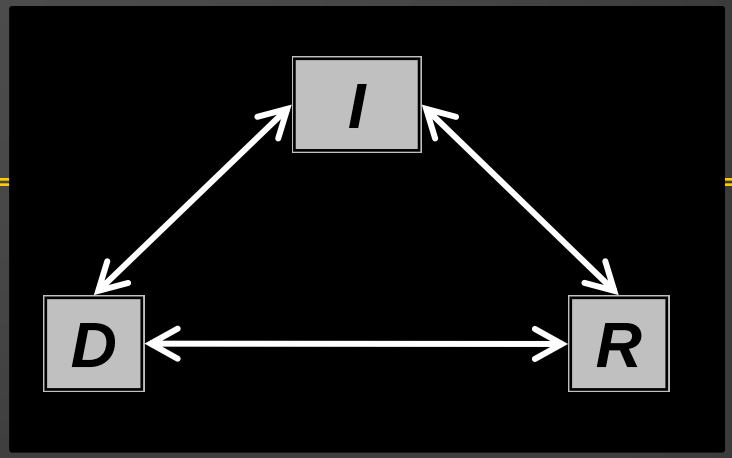
From R&D to RID



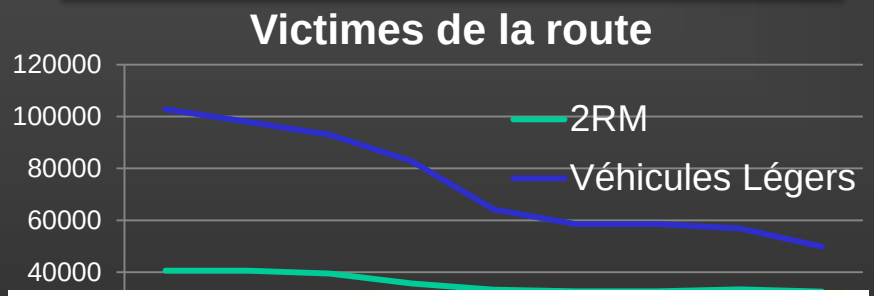
- New methods,
- New organizations
- New strategies (the design of generic technologies → see CFE project)

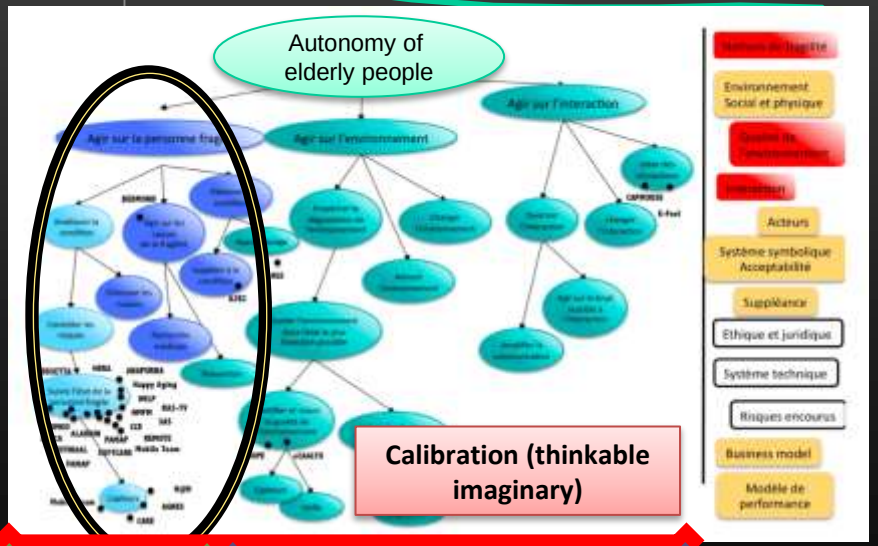
reddot design award winner 2013

But the firm alone can not overcome all innovative design issues → new ecosystems?

Cooperative architectures for innovative design

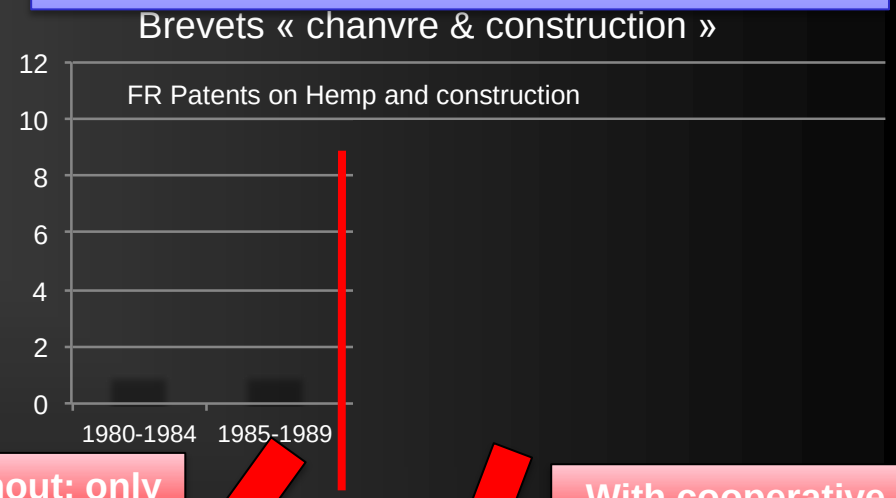
Without cooperative architectures: orphan innovation





Agogué et al. 2012)

With cooperative archiecture: expansion & growth



Without: only one path explored

Hemp for middle age houses restoration

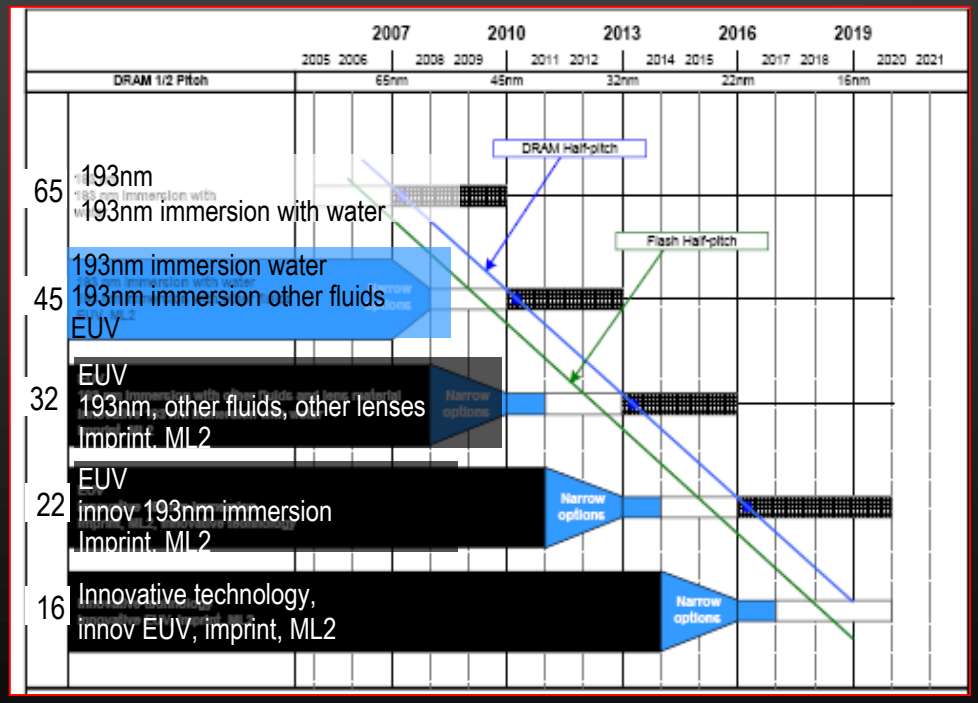
With cooperative archi: creation of multiple paths

Hemp beton, hemp for roofs, for walls, hemp coating, multi-functions (weight, isolation, hygro-inertia,…); with new processes ; for bricks,…

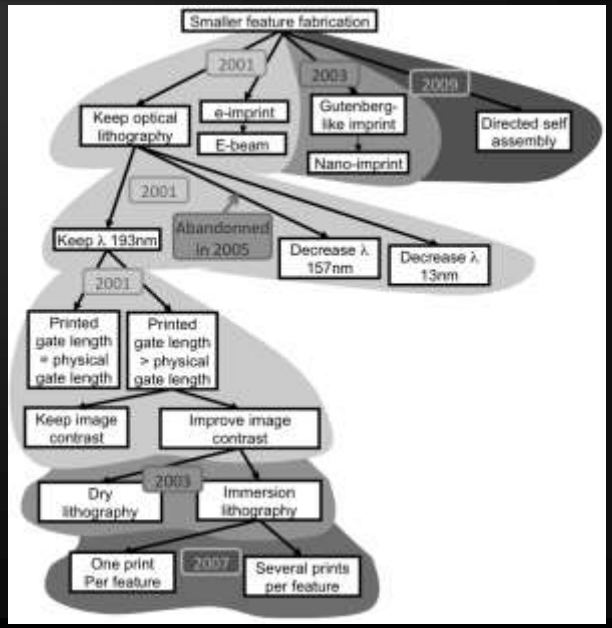
ITRS, International Technology Roadmap for Semiconductors

Cooperative architecture to address Moore's law: ITRS

- Involve the *whole industry* every 4 months
- Free map of all the « unknown », needed technologies: *open agenda of innovations*!
- « We are not picking winners or losers » - NOT planning a single path → NOT decision, but *cooperation for expansion*



Example photolithography → cooperative, expansive reasoning



The logic of cooperative architecture for innovative design

Cooperation of innovative designers (firms, labs, users,…) to expand « **common unknown** »

- Larger set of concepts, increase defixation
- Improved methods at the archi level
- Improve innovative design capacities inside companies
- Limit false expectations
- Better risk management at the ecosystem level
- Open to new partners

Variety of forms: « pôles », NGOs, professional associations, (some) research labs, schools, universities,…

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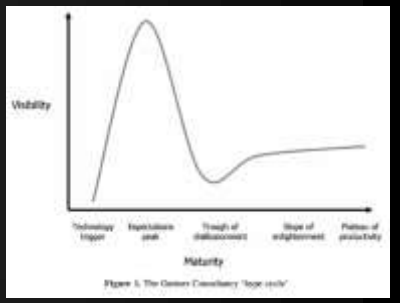
Characterizing the capacities needed for transition

	Optimization… and its risks	Innovative design
Reasoning	Decision-optimization → fixation	Expansion
Organization	R&D → no regeneration	RID
Governance	Asset mgt → « low hanging fruits »	Growth
Ecosystem	Value chain → orphan innov, self-destruction	Cooperative architecture

What kind of public policy for innovative design?

Risks of an « incentive » public policy

	Optimization… and its risks	Innovative design	Incentives policy?
Reasoning	Decision-optimization → fixation	Expansion	Fixation ++
Organization	R&D → no regeneration	RID	Only delay collapse?
Governance	Asset mgt → « low hanging fruits »	Growth	Perverse incentives
Ecosystem	Value chain → orphan innov, self-destruction	Cooperative architecture	Speculative bubbles



« Incentive » public policy: support to entrepreneurs, to research,…

→ Not adapted to innovative design and transition

→ And even risky

L'enjeu de politiques « capacitaires »

	Optimization… and its risks	Innovative design	Incentives policy?	Capacity policy?
Reasoning	Decision-optimization → fixation	Expansion	Fixation ++	Education
Organization	R&D → no regeneration	RID	Only delay collapse?	« Innovation quality » norms
Governance	Asset mgt → « low hanging fruits »	Growth	Perverse incentives	Innovation report
Ecosystem	Value chain → orphan innov, self-destruction	Cooperative architecture	Speculative bubbles	Design referentials

Today? Some examples

- Education? See companies (Thales,…), univ (Stanford,…)
- Organization? Innovative design, routinized process in some companies
- New governance? See SPE, B-Corp,… (Levillain 2014)
- New ecosystems? See Fraunhofer, chinese incubators,…

- German ecosystem: companies are not alone in front of innovation!
- Powerful design experts: Fraunhofer Institutes
  - ✓ 2MM€ turnover
  - ✓ 22 000 people
  - ✓ 66 instituts
  - ✓ Autonomous innovative design policies at the ecosystem level