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The public governance of research

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Pacte

SCIENCES PO Grenoble

Foreword…

“The fact that Galileo successively worked in a university, then for the Republic of Venice, and finally at the court of the Grand Duke of Tuscany is of direct relevance to the kind of knowledge he produced”(Pestre, 2005: 30)

Today’s presentation

Part 1: an historical overview

Part 2: from the 1970s onwards

Part 3: a case study on nanomedicine

Part 1: an historical overview

- From the 16e century to 1870

- The “nationalization of science” (1870 – 1970)

From the 16e century to 1870: the patronage of science

- Practical mathematics (16e-17e)
- Agronomy (18e)
- Electricity, chemistry (19e)

The “nationalization of science” (1870 – 1970)

- Welfare state

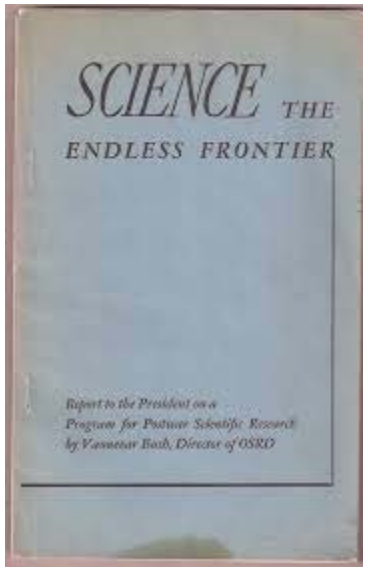
- Keynesian State

- Warfare and colonial State

The “nationalization of science” (1870 – 1970)

- A “social contract” between science and society

Bush Vannevar (1945). *Science-The Endless Frontier: A report to the President on a Program for Postwar Scientific*



- A linear vision of innovation (“science-push”)

In France, large State-funded technological programs

Bull

State

Industry

Academia

A world-wide example: the “Green Revolution”

- William Gaud, USAID : “It is not violent Red Revolution like that of the Soviets, nor is it a While Revolution like that of the Shah of Iran. I call it the Green Revolution”.

- The promotion of intensive farming (improved seed, chemical fertilizers, pesticides, irrigation water and improved management)

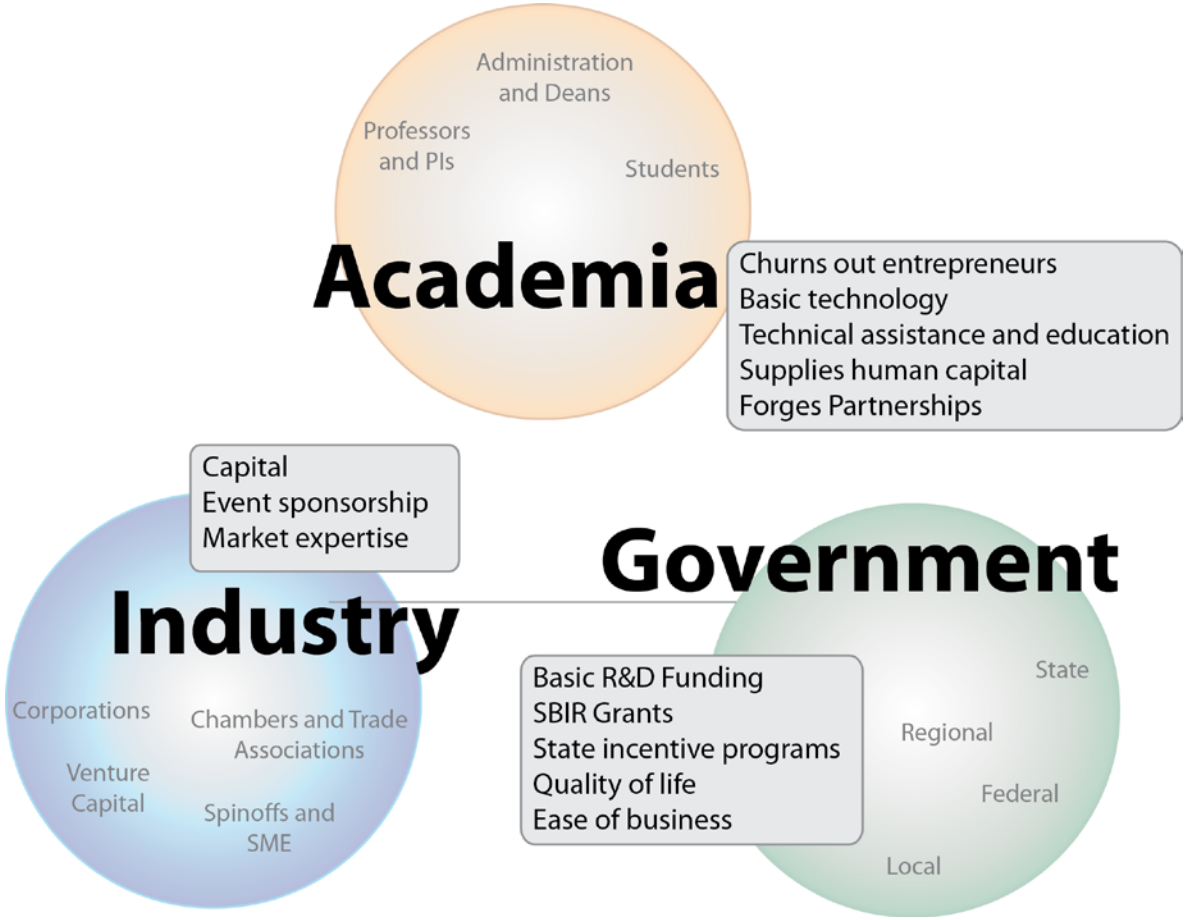
- In France, the central role of the French National Institute for Agronomic Research (INRA) - French *Official Catalogue* for Plant Varieties and Species

Part 2:
from the 1970s onwards

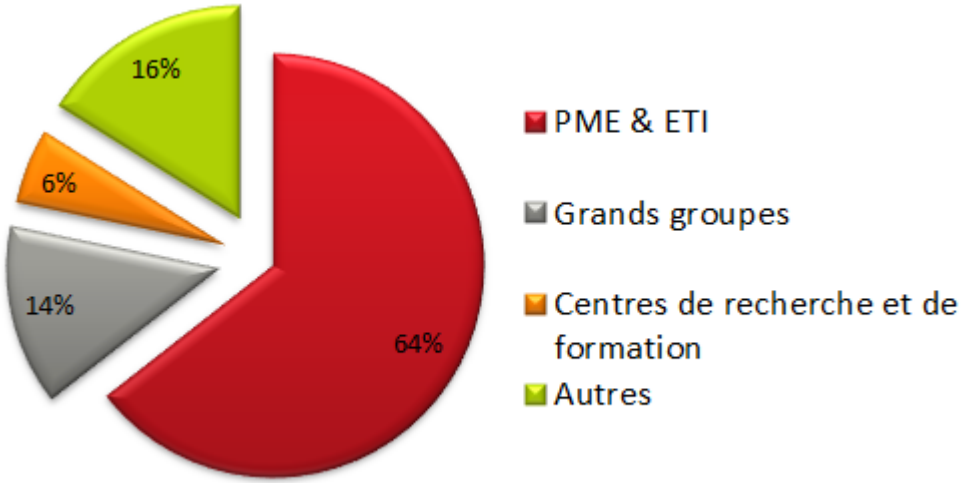
-the “Triple Helice” of University-Industry-Government Relations

-The rise of neoliberalism in science?

The "Triple Helice" model of University-Industry-Government Relations (Etzkowitz and Leydesdorff, 1997)



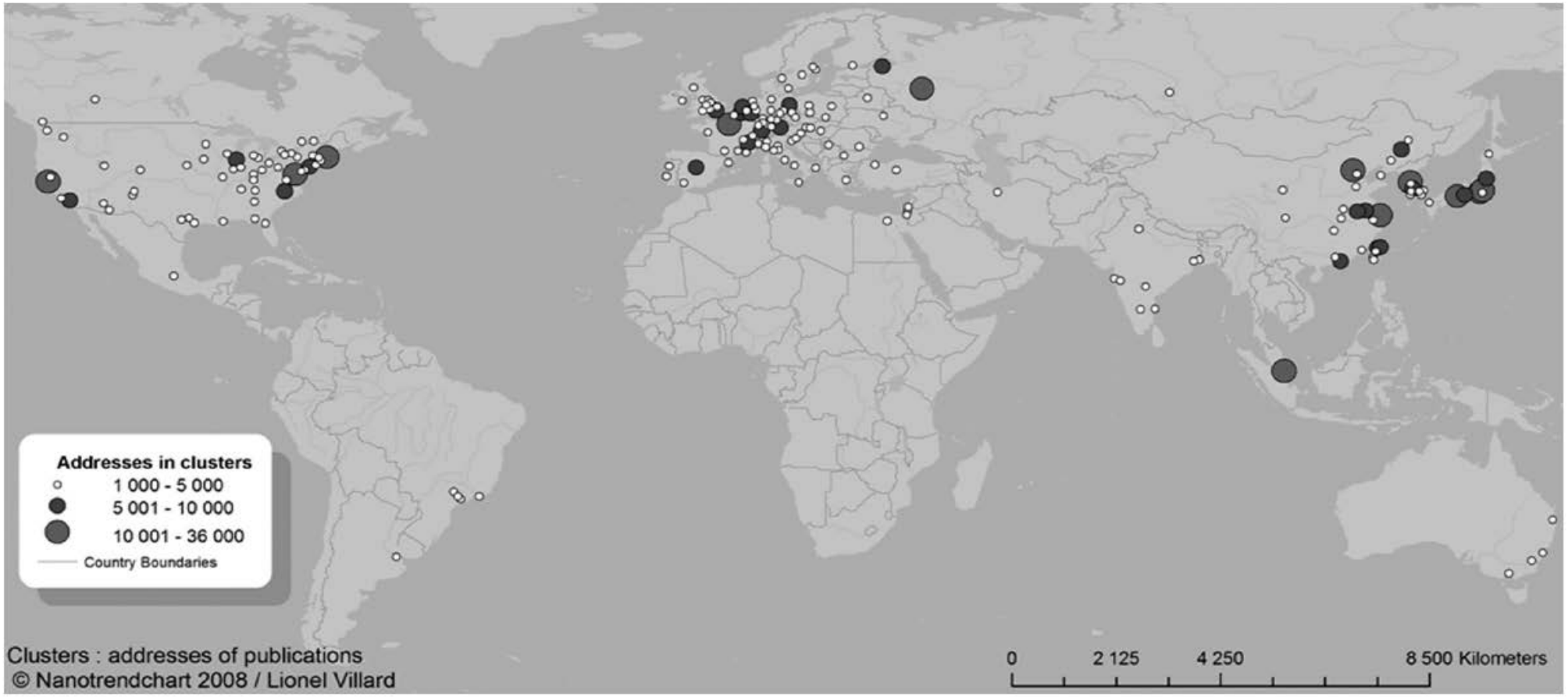
The example of Minatec



220 members

The formation of local innovation systems

MAP 1. LOCALIZATION OF THE 203 NANOCLUSTERS WORLDWIDE



Larédo et al. 2010

Key features of the Triple Helix Model (1)

Changing funding schemes for research and innovation

Research funding in the US: Rollback of gov. funding for public research universities

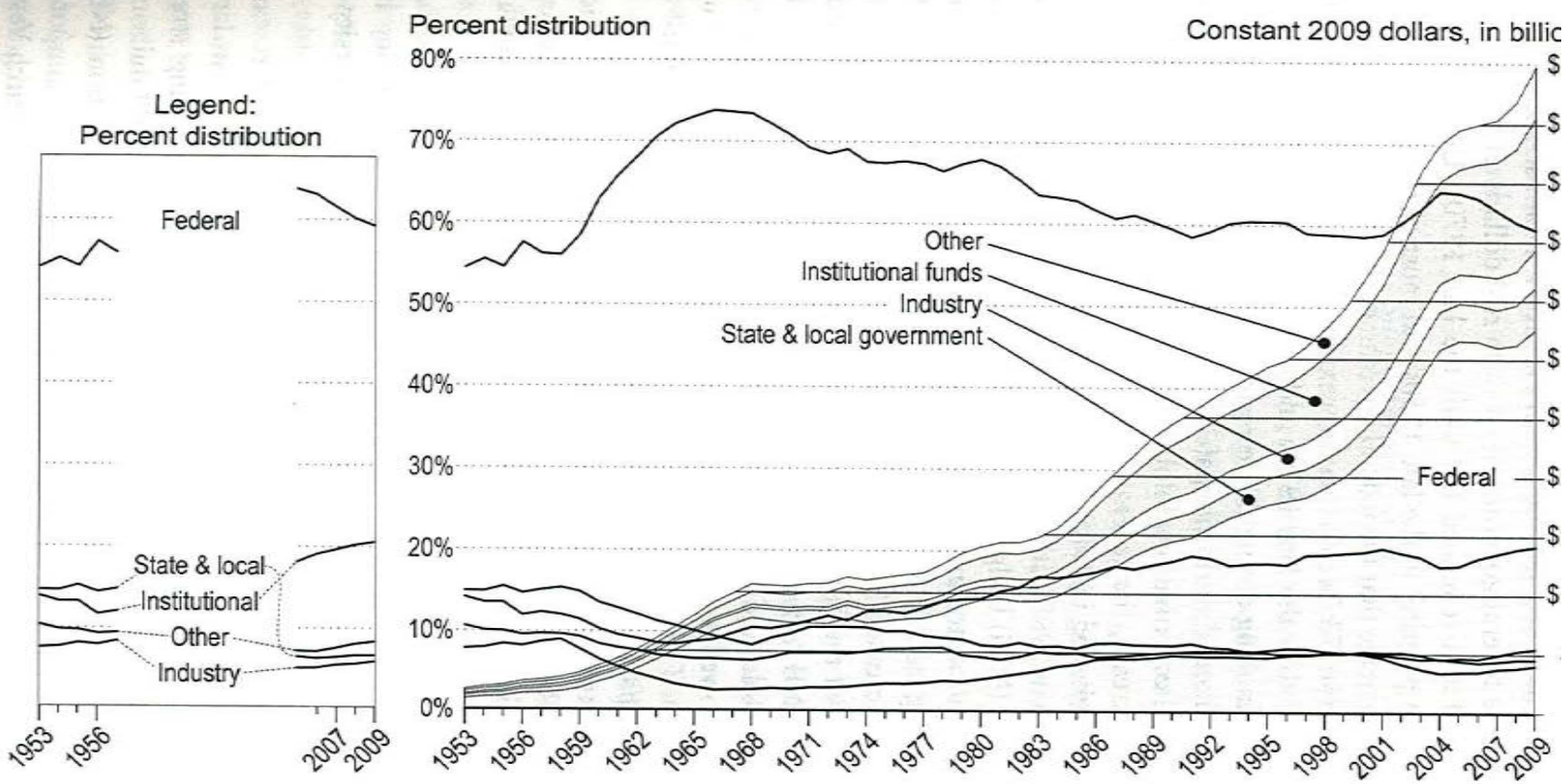


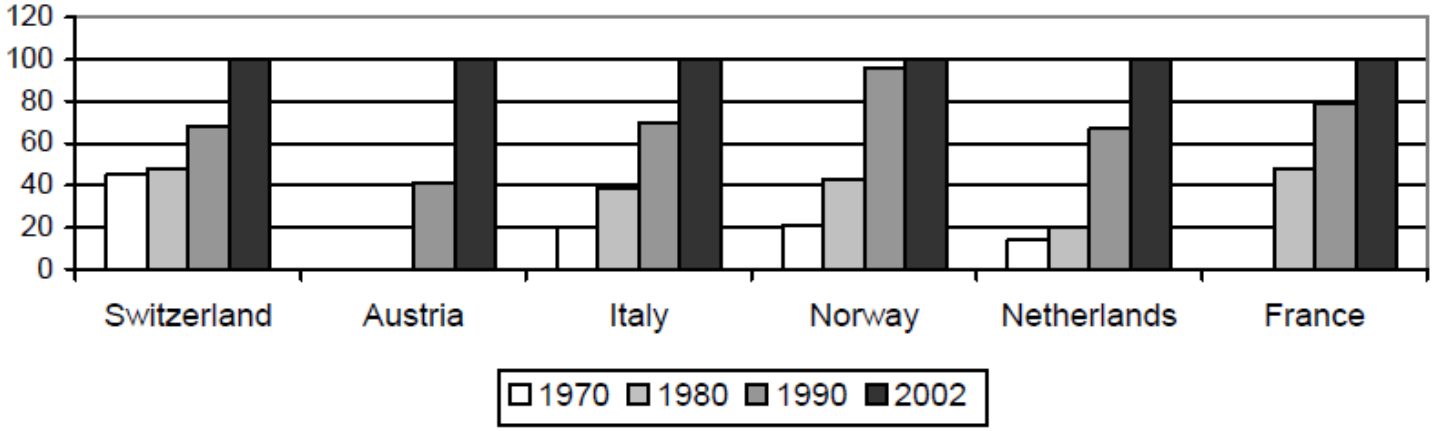
Figure 6.1. Research and development expenditures at universities and colleges by source, 1953–2009. *Source:* National Scienc Foundation (2010a and 2010b).

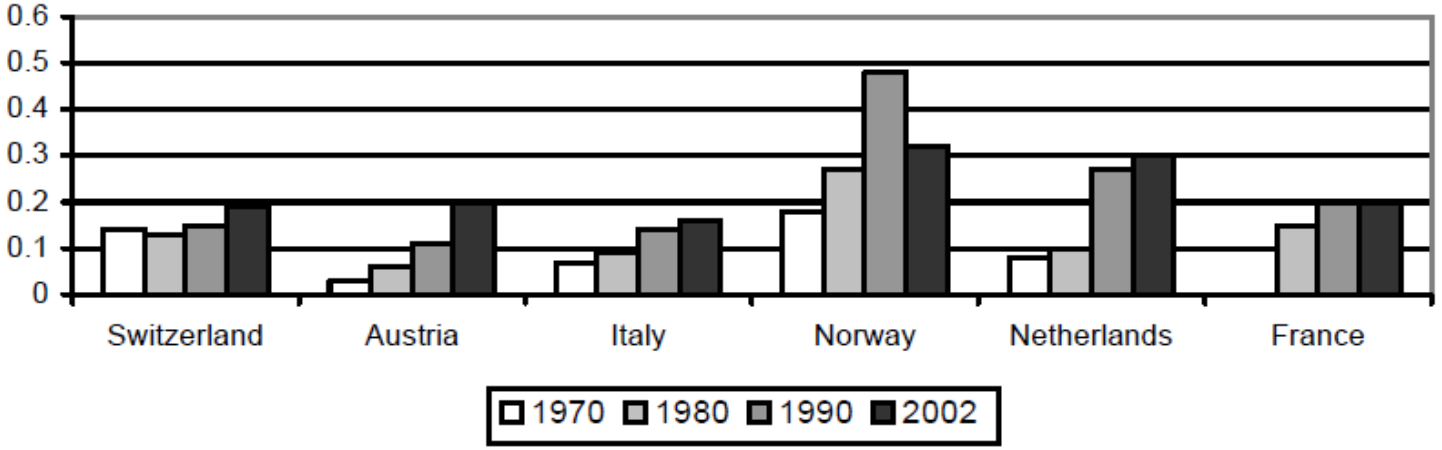
Stephan (2012)

What is happening in OECD countries?

Public funding for academic research in 2008

	Competitive funding	Recurrent funding	Total
	sur projet (%)	de type institutionnel* (%)	%
France	6 à 7	94 à 93	100
Allemagne	7	93	100
Autriche	10	90	100
Pays-Bas	20	80	100
Suisse	27	73	100
Canada	45	55	100
Irlande	50	50	100
Australie	53	47	100
Belgique	66	44	100
Corée	83	27	100





Lepori et al. 2007

Figure 4. Evolution of project funding in real terms (2002=100) and as % of GDP

Notes: Italy: 1970 refers to 1971 (first year available)
France: 1980 refers to 1982 (first year available)
Netherlands: 1970 refers to 1975 (first year available)

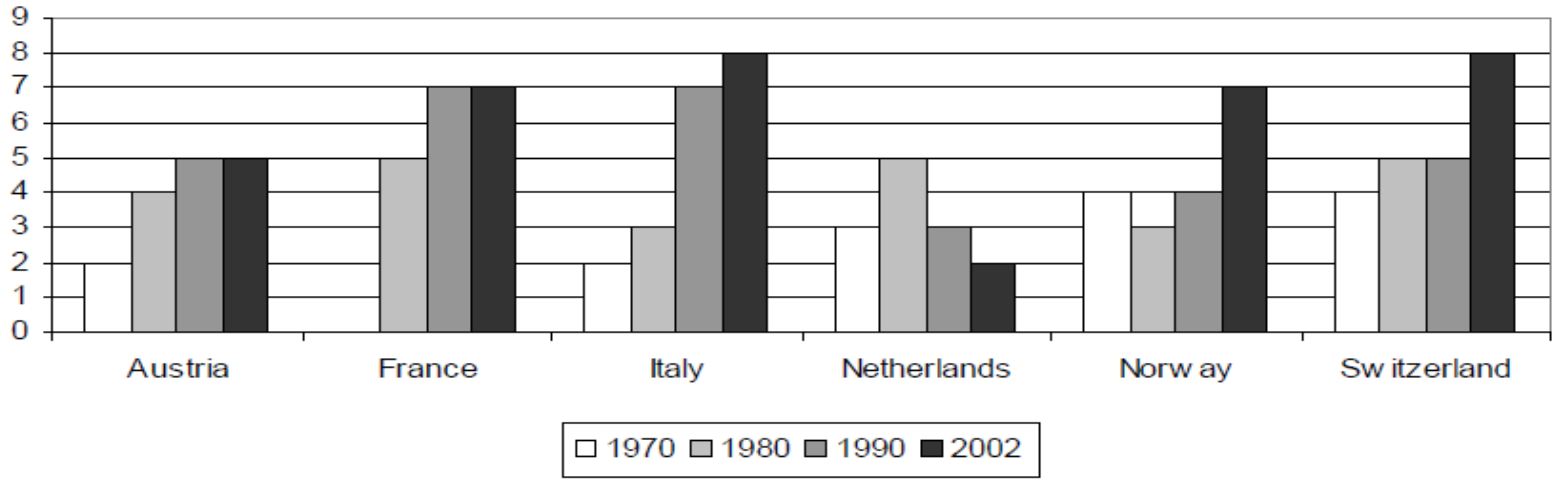
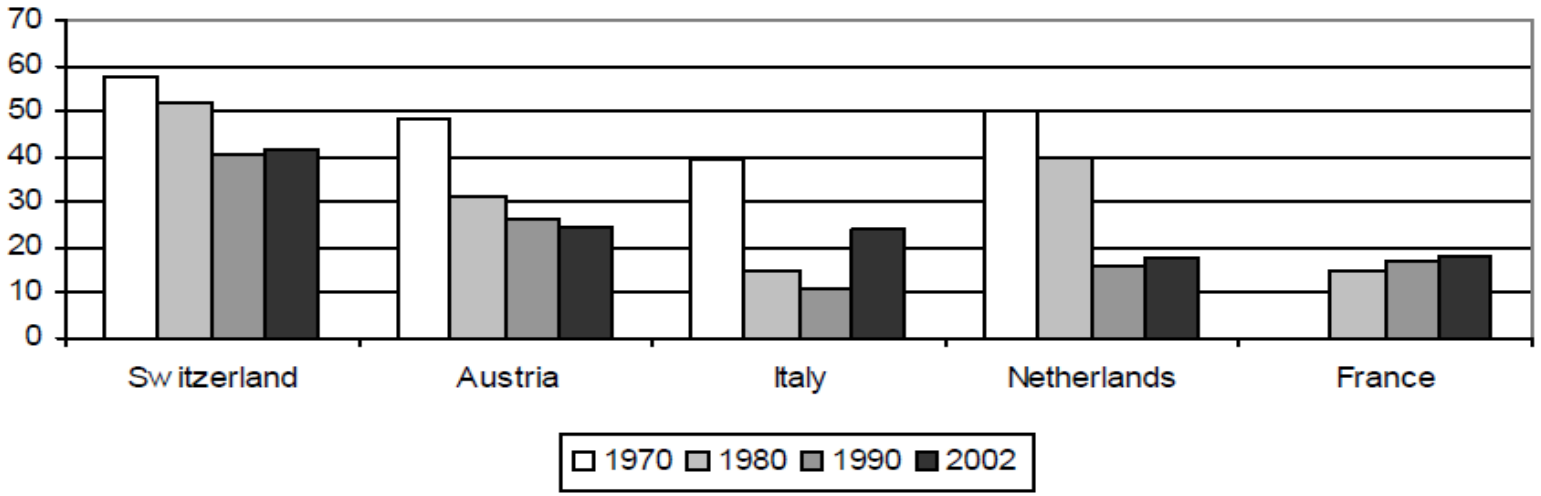


Figure 5. Diversification of project funding instruments
Notes: Number of instruments with a share>5% of the total volume of project funding
ESA and EU FP and public administration contracts are considered as a single instrument

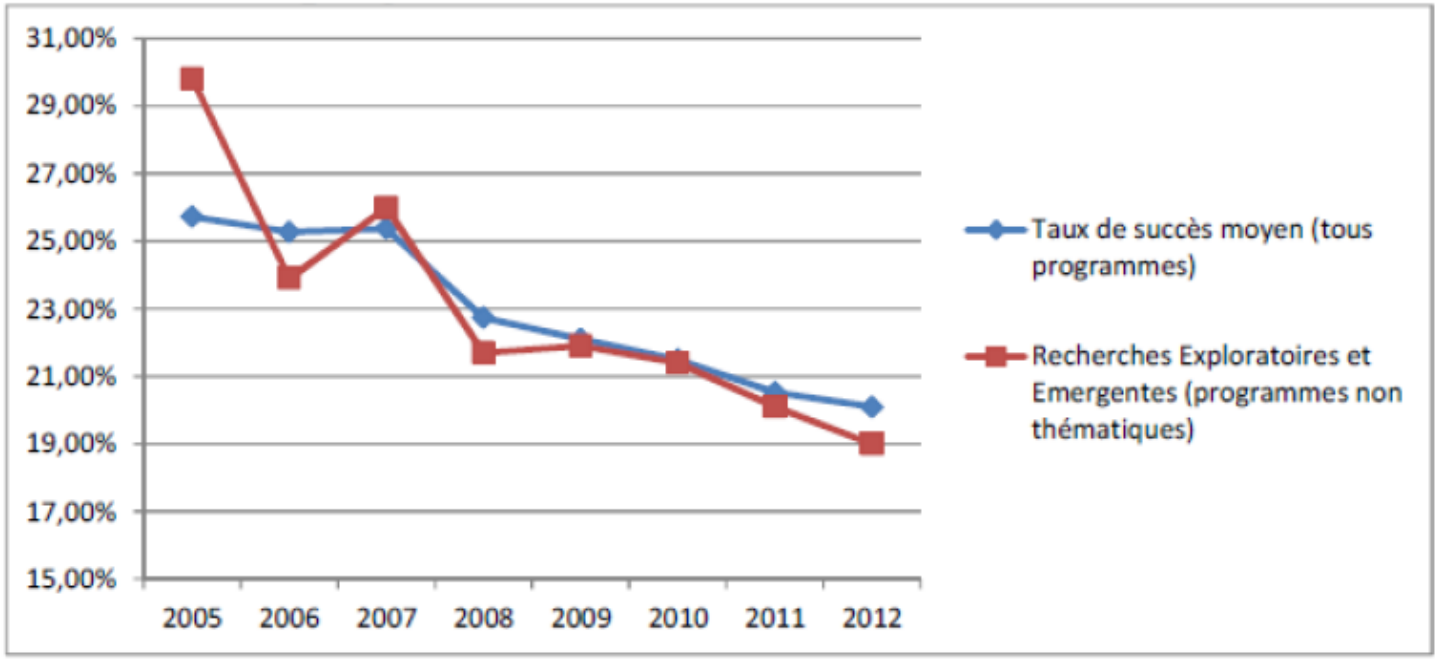


Lepori et al. 2007

Figure 6. Share of academic-oriented instruments by country 1970–2002
Notes: Netherlands, 1970 refers to 1975; Italy, 1970 refers to 1971; France, 1980 refers to 1982

In France: increased competition for funding

Evolution du taux de succès aux appels à projet ANR



Source : Cour des comptes à partir des données de l'Agence nationale de la recherche

Some consequences (Hubert and Louvel, 2012)

- Research becomes **bureaucratic** (e.g. the European Commission monthly timesheets)
- **“Collectivization” vs. “individualization”** of scientific work
- **The “industrialization”** of scientific work
- **New hierarchies** within and between organisations, and between countries

Key feature of the Triple Helix Model (2)

The facilitation by public authorities of knowledge commercialisation

The expanding protection of intellectual property: patents

- **The Bayh-Dole Act** (1980) in the US. **Universities retain ownership to inventions made under federally funded research**.

In return, universities are expected to file for patent protection and to ensure commercialization upon licensing. The royalties from such ventures are shared with the inventors; a portion is provided to the University and department/college; and the remainder is used to support the technology transfer process

Material transfer agreements (MTAs)

- "A **Material Transfer Agreement** (MTA) is a contract that governs the transfer of tangible research materials between two organizations, when the recipient intends to use it for his or her own research purposes. The MTA defines the rights of the provider and the recipient with respect to the materials and any derivatives. **Biological materials**, such as reagents, cell lines, plasmids, and vectors, are the most frequently transferred materials, but MTAs may also be used for other types of materials, such as **chemical compounds** and even some **types of software**" (UC Berkeley)

Some potential consequences: a latent privatization of public knowledge?

- **Why has the BDA been so successful?**

"The scope of what is deemed susceptible to patenting in America has been progressively broadened (…). **It is now possible to patent anything from living beings, to computer code, to business practices; the patent system has come dangerously close to allowing the patenting of ideas themselves**" (p. 666)

- **Consequences of material transfer agreements**

→confidentiality clauses

→ delay in publication

→Definition of material

→Loss of control of IP; etc.

A radical thesis: the rise of neoliberalism in science (Lave et al. 2010)

- The aggressive promotion and protection of intellectual property by companies in hopes of gaining commercial value from knowledge

- Science is increasingly being produced for particular markets, with a resulting contraction in the focus of research

Part 3: a case study

How do funding programs impact academic science?

A sociological study on nanomedicine in France and in the United States

Funding agencies and the government of research

- The rise of competitive project-based funding in OECD countries

- Organisational and professional consequences (Hubert, Louvel, *Mouvements,* 2012)

- Concerns about the epistemic poverty of the knowledge produced… But no systematic accounts of how project-based funding modifies the content of funded research (Gläser, Laudel, *European Journal of Sociology, 2016)*

Funding agencies and the definition of relevant research

- Funding agencies favor the rise of “strategic science” (Van Lente and Rip, 1998)

- To what extend do funding agencies align definitions of “relevant research” among researchers funded by the same program?

Funding agencies and epistemic commitments

"***Epistemic commitments***" are "Different views of knowledge that matters and how these views are embedded in research practices and networks"

"The notion does not describe political or ethical views about science and the role of scientists: instead, it describes research work as an ethical and political commitment to the production of a certain type of knowledge"

(Granjou and Arpin, 2015, Granjou, Louvel, Arpin 2015)

Do funding agencies initiate new epistemic commitments among researchers?

If so, where does their normative strength come from?

Overview of the sociological study

- A sociological study on interdisciplinary nanomedicine (France, California, Texas) funded by the ANR (PI: S. Louvel)
- Funding programs for nanomedicine: two phases
- The promotion of technological innovation in the early 2000s: a diversity of epistemic commitments
- The rise of therapeutic expectations from the mid 2000s onwards: the quest for “valid” interdisciplinary research and shared epistemic commitments

A sociological study on interdisciplinary nanomedicine

Nanomedicine= the application of nanotechnologies to biomedical problems

- Why a sociological study on nanomedicine?

The Human and Social Sciences and the “Nano-Hype”

- Empirical study

App. 70 interviews with scientists, representatives from funding agencies and firms, in France, California and Texas (2011-2015)

Document analysis on call for tenders, funded projects, publications

Bibliometric analysis of publications

Funding programs for nanomedicine: two phases

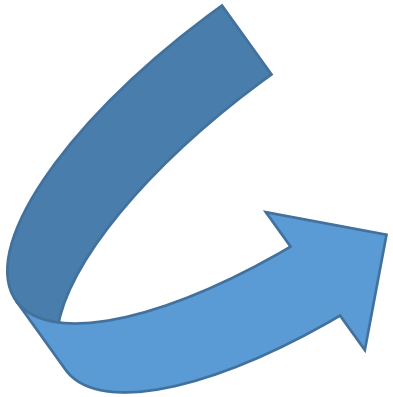
The promotion of technological innovation

NIH *Nanomedicine Development Centers*, first phase (2005-2008)

Funding programs for nanomedicine: two phases

The promotion of technological innovation

NIH Nanomedicine Development Centers, first phase (2005-2008)



Therapeutic expectations

NIH *Nanomedicine Development Centers*, 2nd phase (2008-)

The promotion of technological innovation: several epistemic commitments

- **Looking for long-term challenges**

“We didn’t choose the disease targets based on how easy they would be to solve, more on how bad the disease was” (Professor, structural biology, UC Berkeley)

"Our long-term goal is to understand the fundamentals of cellular and cell-like devices." (Cell Propulsion Lab, Activity Report, 2006).

- **Diverse epistemic commitments to “basic” to “applied” science**

"I have not found the nano***medicine*** concept useful for me. I think some of the people who got involved in the center really got inspired by the concept. I found it much more useful to think about how we can use engineering approaches for complex molecular machines (Professor, bioinformatics and bioengineering, UCSF)."

Therapeutic expectations: the quest for “valid” interdisciplinary research

- Funding agencies promote translational research and expect short-term applications

"I remember vividly one meeting in DC, that was probably during the second year of funding, when one of the institute director said: ‘***you need to have something done with a mouse, in a year***’. I did not like the feeling that they were trying to lure people that were doing just really fundamental research "(Professor, cell biology, UCSF).

- Shared epistemic commitment to turn nanomed lab work into preclinical research

Shared epistemic commitment towards preclinical research

- “Research that matters” combines scientific, medical, industrial and regulatory acceptance considerations

- Quasi-contractual obligation vis-à-vis funding agencies as well as the "general public“ to make credible therapeutic promises

*Are nanomedicine drug delivery systems really “**smart**” or **SMART**:*

*"**S**ystems (somewhat) **M**odulating **A**dverse **R**eactions and **T**oxicity" or "**S**ystems (somewhat) **M**ore **A**ble to **R**each the **T**arget site " (Lammers, 2013).*

Three dimensions of the shared epistemic commitment

- Responding to a “clinical need”
- Characterizing nanoparticles
- Toxicity: defining zones of knowledge and “non-knowledge”

Responding to a “clinical need”

- A clinical need combines regulatory definitions, medical considerations, usability testing and economic evaluation

✓Limitations on researchers’ choices

“we sought to fund a proof of concept on breast cancer in rats. We show that cancer develops much less with our particle, but ***we were told*: *nobody will fund this research, there are today treatments for this cancer***." (Professor, Chemistry, France)

✓New evaluation criteria of nanomed research

“Evaluating nanomedicine solely ***on the basis of the % of nanoparticles that reach the tumour is unconventional*** *(…) The parameters used in measuring the success of nanomedicine translation to the clinic should include considerations of* ***pharmacokinetics, toxicity, efficacy and the overall impact on patient outcomes****”* (McNeil, 2016)

Characterizing nanoparticles

- A scientific issue which also becomes an industrial and regulatory one (need to apply to *Good Manufacturing Practices* certification)

✓The ***National Characterization Laboratory*** (NCI-NIH), a "boundary organization" (Guston, 2001)

"It has developed a standardized analytical cascade that tests the preclinical toxicology, pharmacology, and efficacy of nanoparticles and devices".

✓"**Soft law**": guidelines and precautionary statements

"Scientists have to critically think, if there is a real biological or medical need for all what can be done from a synthetic point of view. (...) We have to identify the minimal level of complexity that still leads to a therapeutic effect but also allows for clinical translation." (Barz, 2015)

Toxicity: defining zones of knowledge and "non-knowledge" (Gross, 2007)

- Evidence of non-toxicity is a regulatory requirement… But conventional tools for assessing toxicity are not entirely reliable

✓**Shared commitment** to adopt a "culture of risk"

"The regulatory agency told us: 'This team had these results, we do not understand them, but check, when you have injected your product, measure what is left in the lung'. So, we added a test in our list: we must test on the lung. (Head of a nanomedicine program, France."

✓**Controversies** about the best option to minimize risks

"People who design metal nanoparticles today will not sell a single to a pharmaceutical industry. Because this concept cannot be accepted anymore (Biochemist, France)."

Conclusions

Do funding agencies initiate new epistemic commitments among researchers?

... Only when funding programs formulate performative expectations (Pollock and Williams, 2010): prescribing means of action and scientific directions

Programs promoting **technological innovation in nanomedicine**:

-are non-prescriptive

-few criteria to differentiate between successes and failures

Nanomedicine is a label, epistemic commitments remain disciplinary.

Conclusions

If so, where does their normative strength come from?

Funding programs defining therapeutical objectives:

-Support the creation of research networks and technological platforms where scientists, firms, regulatory agencies define “research that matters”

-Limit scientific options but do not eliminate uncertainties and controversies about research directions and evaluation criteria

-Provide arguments for the promotion of nanotechnology (uncertainty redefined as an appropriate risk-benefit ratio)

-Stimulate a broader reflection on quasi-contractual obligations towards funders, regulatory agencies and general public

Thank you for your attention!

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