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Systems of Innovation

Learning economy and innovation
Science & technology systems at national and regional levels
European policies

(EMIK presentation)

Science, innovation & economy

Schumpeter (1931):
Innovation als Durchsetzung neuer Kombinationen

- "*Herstellung eines neuen, d.h. dem Konsumentenkreis noch nicht vertrauten Gutes oder einer neuen Qualität eines Gutes, (...)*
- *Einführung einer neuen, d.h. dem betreffenden Industriezweig noch nicht praktisch bekannten Produktionsmethode, (...)*
- *Erschließung eines neuen Absatzmarktes, (...)*
- *Eroberung einer neuen Bezugsquelle von Rohstoffen oder Halbfabrikaten, (...)*
- *Durchführung einer Neuorganisation wie Schaffung einer Monopolstellung (...) oder Durchbrechen eines Monopols".*

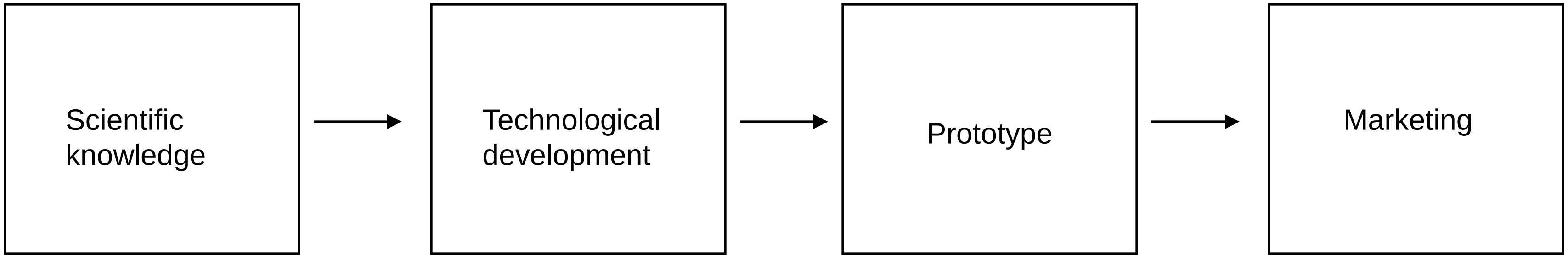
Innovation following Schumpeter (1931)

- *New product (not yet known at consumer‘s level) or new quality of existing good*
- *New production method (process not yet known in the sector)*
- *Opening a new market*
- *Introducing a new natural resource or intermediate product*
- *New organisation (impacting production process, or industry structure)*

Technology push *versus* demand pull **(1)**

- „Technology push“

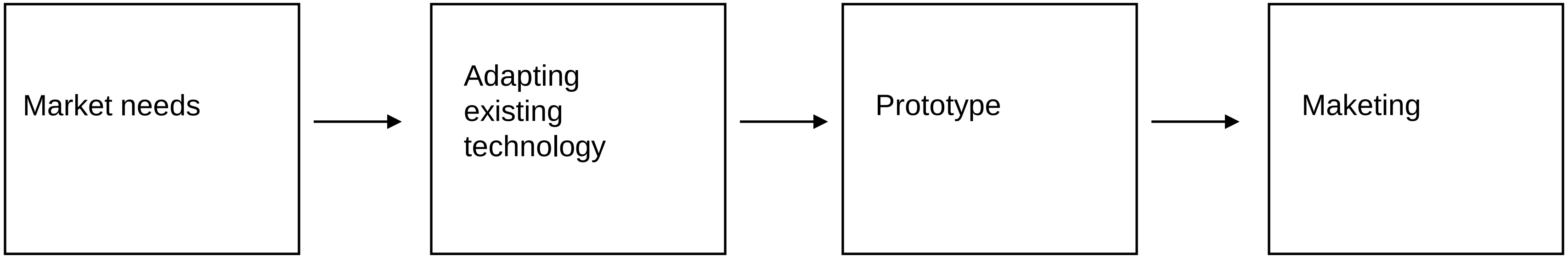
  (Schumpeter I)



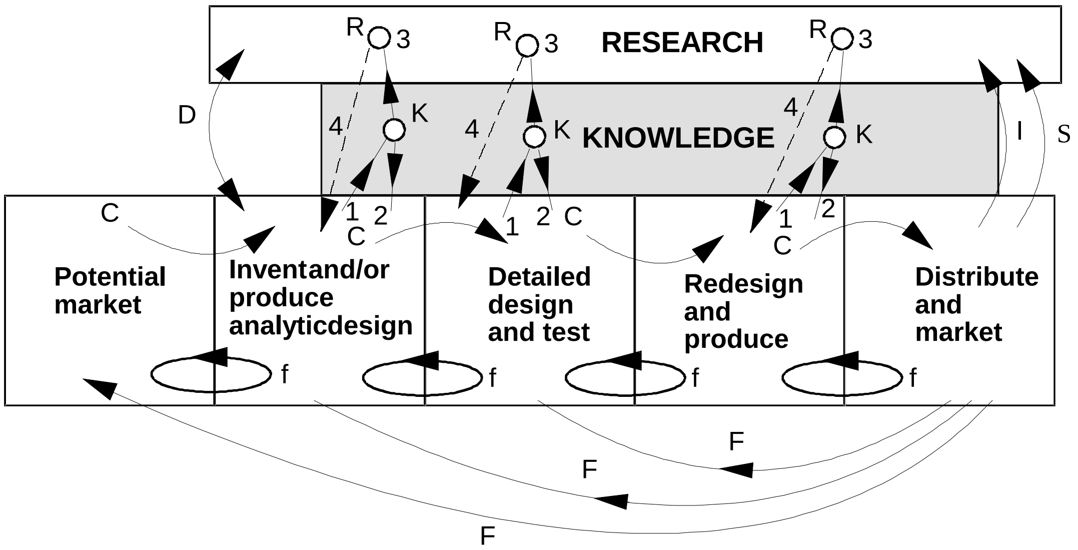
Technology push *versus* demand pull

- „Demand pull“:

  (Schmookler)



„Chain-linked model“ (Kline & Rosenberg, 1986)



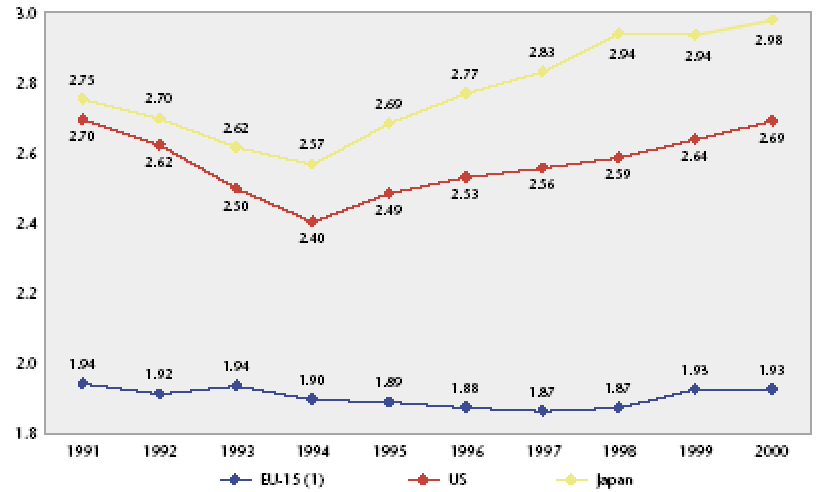
C = Central-chain-of-innovation
f = Feedback loops
F = Particularly important feedback
K-R = Links through knowledge to research and return paths. If problem solved at node K, link 3 to R not activated. Return from research (link 4) is problematic - therefore dashed line.
D = Direct link to and from research from problems in invention and design.
I = Support of scientific research by instruments, machines, tools, and procedures of technology.
S = Support of research in sciences underlying product area to gain information directly and by monitoring outside work. The information obtained may apply anywhere along the chain.

Three levels of knowledge creation

Levels	**Activities**	**Results** ***measurement***
Science	Basic Research (exploratory or finalised)	Scientific discovery ***publication***
Technology	Applied research	Invention ***patent*** *(not systematically)*
Economy/ society	Industrial/ commercial developement	Innovation *Sales, profits, employment,…*

The stakes:
Innovation: the European challenge

Figure 2.1.5 R&D intensity (%) in the EU-15, the US and Japan, 1991–2000



Source: DG Research
Data: OECD – MSTI database (STI, EAS Division) with DG Research provisional estimates
Note: (1) L data are not included in EU-15 average.

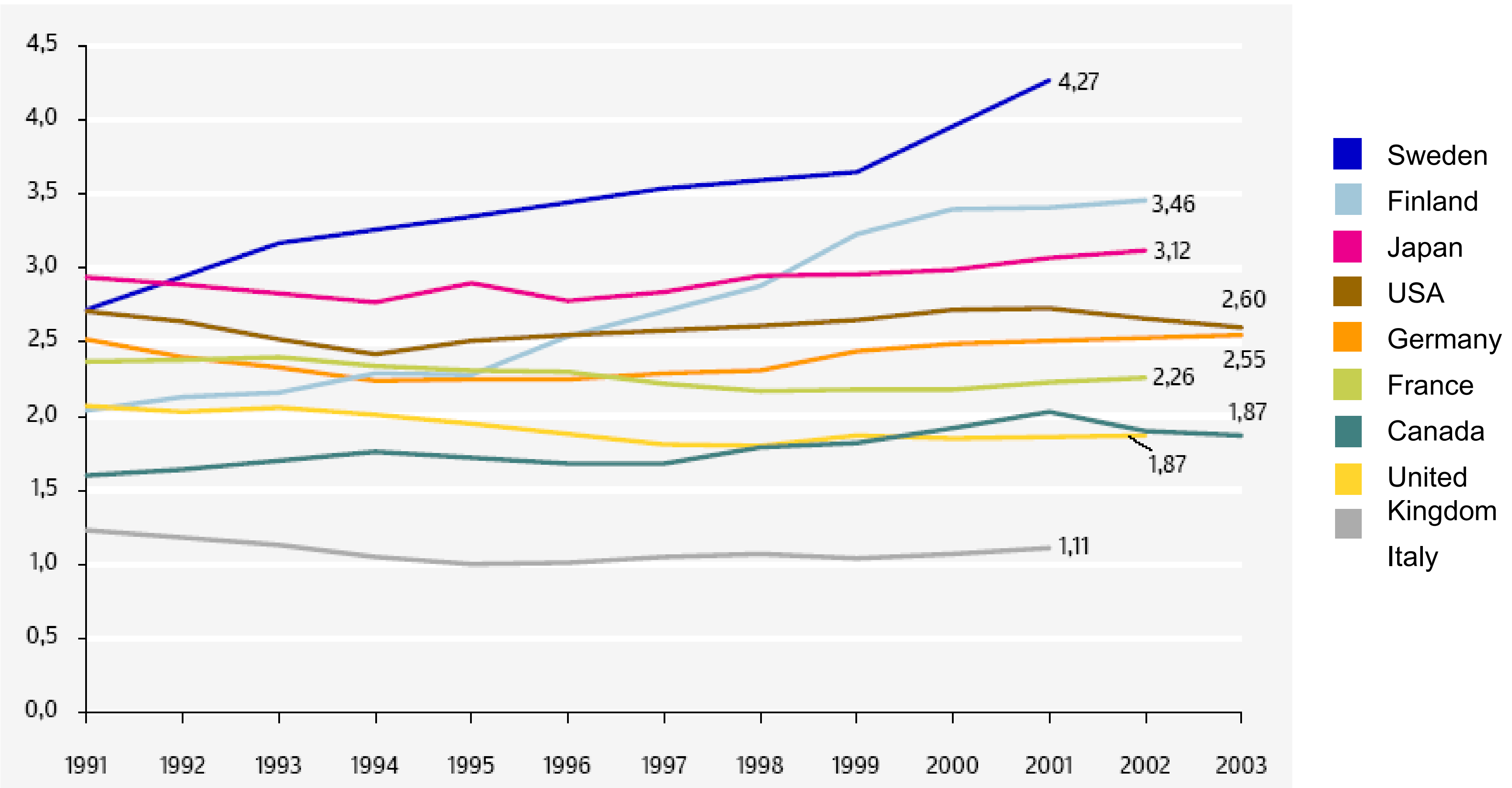
Third European Report on S&T Indicators, 2003

Estimates of the possible evolution of research expenditure in the 2000–2010 period are examined next. Figure 2.1.6 shows potential scenarios for the evolution of R&D intensity during this period. Growth rates were calculated for the EU, the US and Japan for three time periods within the last decade: one for the entire decade; the second for the period 1994–1999; and the third for 1996–1999. For each economic block, a "best-case scenario" and a "worst-case scenario" growth rate were taken from the highest and lowest rates in the three time periods mentioned above. These are represented in the figure as "min" or "max".

Research expenditure in the EU over the last decade has been relatively stable at around 1.9% of GDP. If the current trend continues, the best the EU could hope for, is a rate of around 2.2–2.3% by 2010. It should be remembered, however, that this is only a "best-case scenario" based on the performance in the 1990s. Calculating a "worst-case scenario" using downward trends would find EU research expenditure at below 1.8% of GDP. It is clear, then, that if the EU is to increase its overall level of research expenditure to a figure approaching 3% by 2010 – as was agreed by the European Council in 2002 in Barcelona – substantial efforts are needed to create the conditions in which this might be achieved.

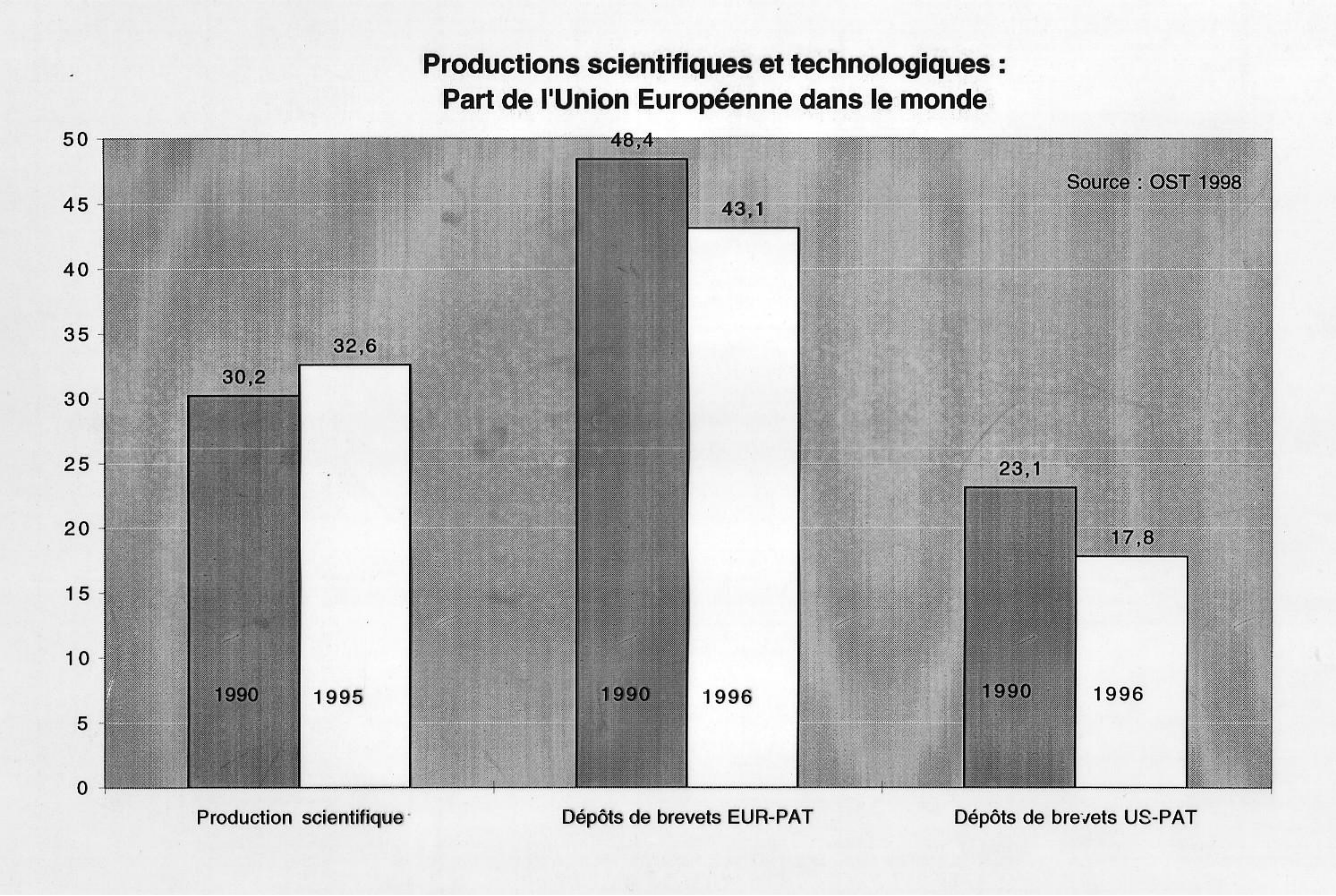
Nevertheless, even by employing the most optimistic of estimates, if there is no major reorientation of public and private policy towards research expenditure, the EU will still be spending well below 2.5% of its GDP on research. Even a "best-case scenario" would be substantially below the current relative level of US spending. The gap between the US and the EU is widening, and will continue to widen over the current decade, unless efforts are increased significantly.

Share of R&D Expenditures in GDP of selected OECD Countries (1991-2003)



Source: BMBF 2005

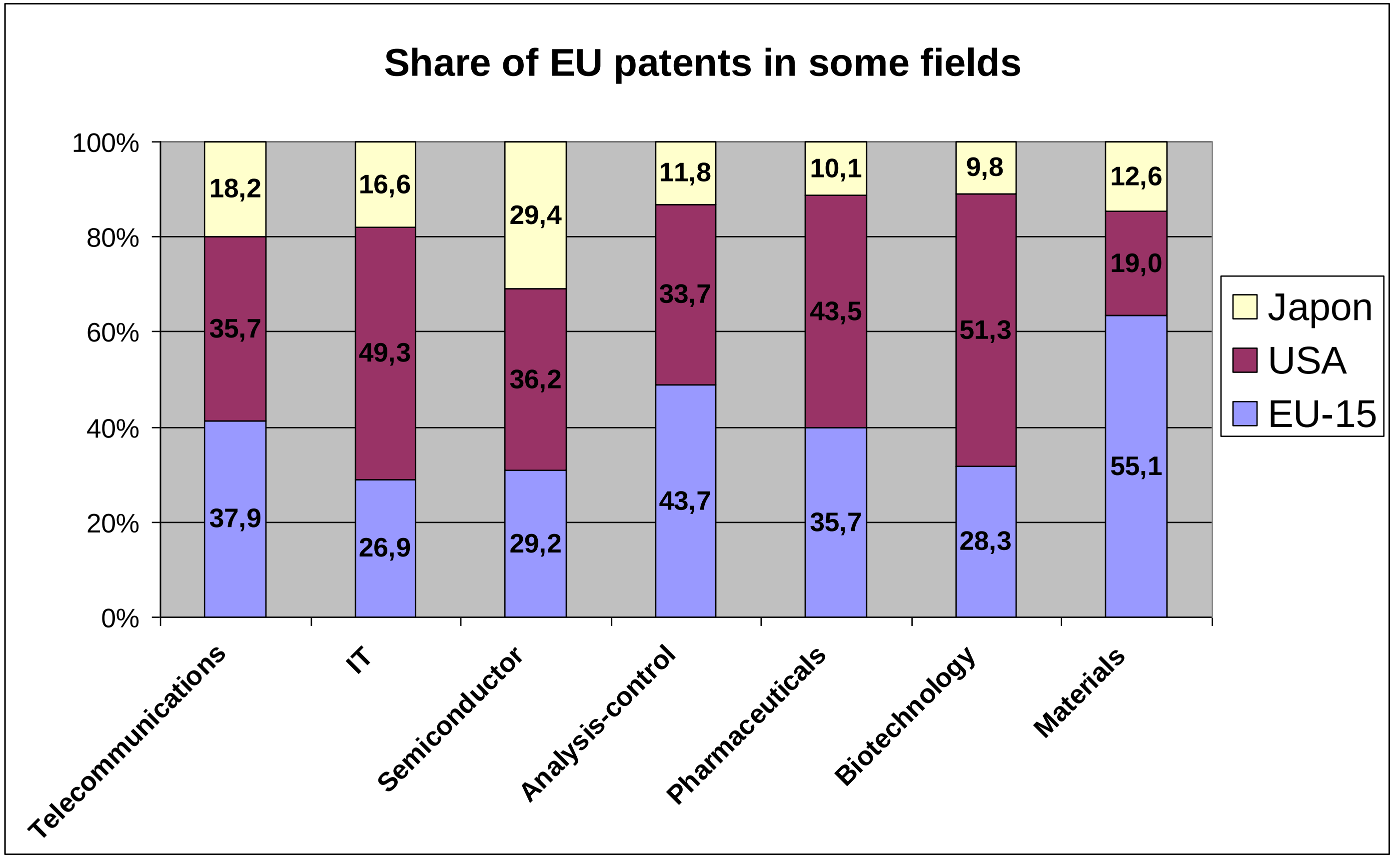
Is EU-15 strong in science, but weak in technology ?



Disciplines Led by the EU, U.S., and AP Region. Metric is papers in the world's leading journals.

Who is in first Place in Publications in 2500 of the world's leading journals? Blank is US Leadership.											
	1981	1983	1985	1987	1989	1991	1993	1995	1997	1999	2001
Agricultural Science							EU	EU	EU	EU	EU
Biology & BioChem											
Chemistry	EU	EU	EU	EU	EU	EU	EU		EU	EU	EU
Clinical Medicine								EU	EU	EU	EU
Computer Science											
Ecology & Enviroment											
Engineering											EU
Geoscience										EU	EU
Immunology											
Materials Science							EU	EU	AP	AP	AP
Math								EU	EU	EU	EU
Microbiology							EU	EU	EU	EU	EU
Molecular Bio & Genetics											
Multidisciplinary	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Neuroscience											
Pharmacology	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Physics		EU			EU	EU	EU	EU	EU	EU	EU
Plant & Animal Science								EU	EU	EU	EU
Psych & Psychiatry											
Space Science									EU		EU

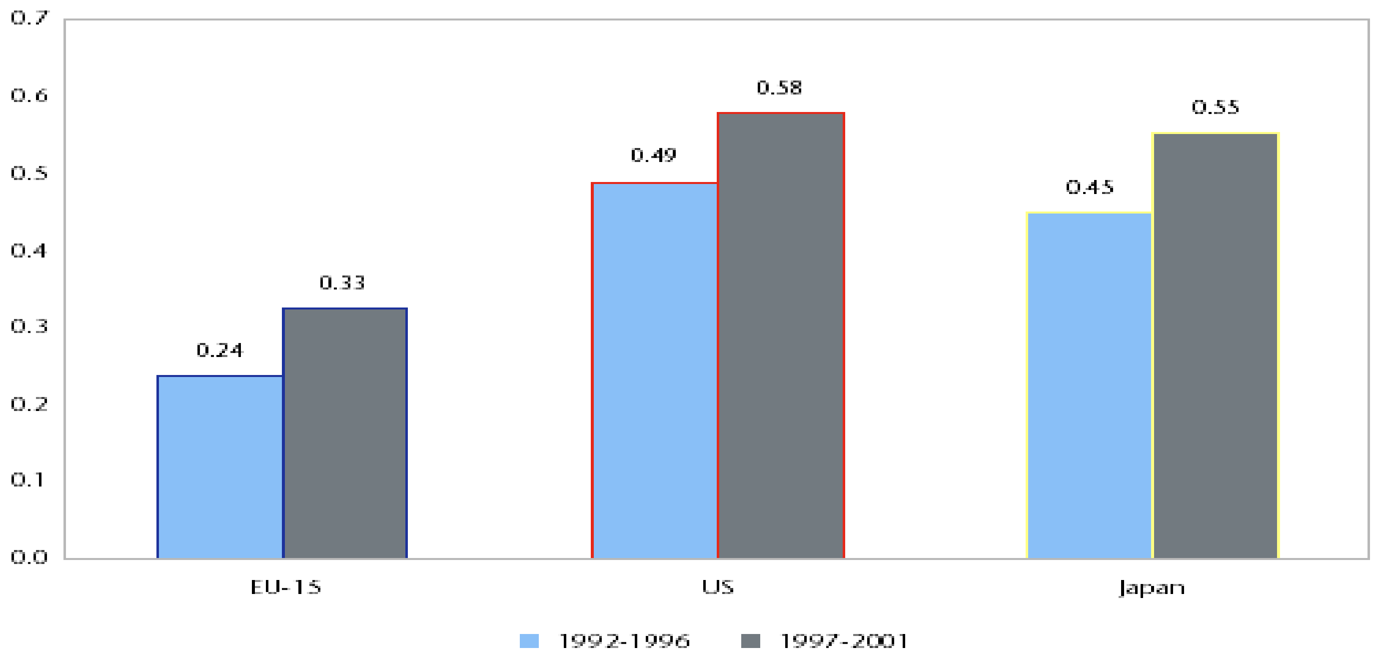
Triad: patenting in science-based industries



Source: Third European Report
Traitement: BETA

A possible measurement of R&D efficiency

Figure 6.1.21 US patents per unit of business R&D expenditure



Source: DG Research
Data: USPTO, data processed by Fraunhofer-ISI; OECD, Eurostat
Note: Business R&D (BERD) measured in million PPS at 1995 prices. Calculated using a two-year time lag between year of R&D expenditure and year of patenting.

Third European Report on S&T Indicators, 2003

Source: Third European Report

General framework:
Towards the European Research Area (ERA)

- Facing US and Japanese challenge in the newest *science-based* industrial achievements and service innovations, EU has designed an ambitious project around the concept of ERA (launched in 2000 by Commissioner Philippe BUSQUIN)
- Broad objective:

- to reshape, in an integrated approach, EU *research programs* and *structural funds;*
- but also to better *co-ordinate member-states science and technology policies;*

for the sake of European competitiveness in the emerging knowledge society.

The knowledge society

- The knowledge society is a post-industrial society based on production and dissemination of information that increases individuals and companies knowledge.

- Main characteristics which distinguish it from Industrial Society:

  - Between labour, leisure and education, the proportion of leisure and education is increasing, and the three activities tend to coexist throughout life

  - It requires more and more high level job qualifications (generic and specialized knowledge, social and emotional competencies)

  - Economic activities are increasingly knowledge-based and even science-based: technologies and work environment are changing more rapidly; workers are to be learned to learn; have the capacity to adapt and to be creative, for “sustainable employability”.

The necessity to reorient European structures and policies :

- Understanding where we come from: the situation in the ‘90s:

  - Science indicators give a good image of Europe: a large share of the world publications, this share being non declining. But technology indicators are not good: declining share of world patents.

  - Europe is a stronghold for several economic activities, but less in the most promising ones than in traditional middle tech branches

- Conclusion in terms of innovation system:

  Europe has interesting assets (industrial and cognitive) but they are not efficiently linked. The science-technology-business chain is weak

The ERA challenge

- Europe must become in 10 years the most successful knowledge-based economy. It means:

  - More research in basic and applied science (from presently a little less than 2% of GDP to 3% and more). See ERA doc

  - Increasing absorptive capacity at firm level (and the willingness to take the risk of breakthrough innovation)

  - More education and training: initial as well as life-long

- This is not only for glory!

  With our standards of living, the ageing population, and therefore the high price of factors, a large part of economic activities that are not based on new knowledge are at risk of being outsourced and displaced in the newly developed countries of the world.

The ways towards ERA

- Better co-ordination of national policies is a way to do more with the same means. There is certainly wasteful duplication of projects in public science and technology performed at national level – and maybe also among firms – a situation leading to global efficiency lower than that of the US system.
- It must be possible to build critical mass using existing facilities, teams and national systems, by networking them. The idea is to focus EU intervention on networking the excellence. Whatever the technical form (*Networks of Excellence* for research consortia of scientific teams accross Europe or *Integrated Programs* including firms and research institutes), the European Commission will concentrate its efforts(*****)on a limited number of projects and of teams. For increasing the leverage, EU finances only a part of the projects: the member states' administrations or the firms must invest at least the half of the cost.

    (*****) *efforts amounting for less than 5% of global European research expenses: there is already a strong multiplier effect of EU RTD programs*
- All levels of governance are likely to be involved: EU, states, regional/local authorities, universities on their own budget, non-profit organizations...

National innovation systems: General approach

Some definitions of NSI

- Freeman 1987

  The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies
- Lundvall 1992

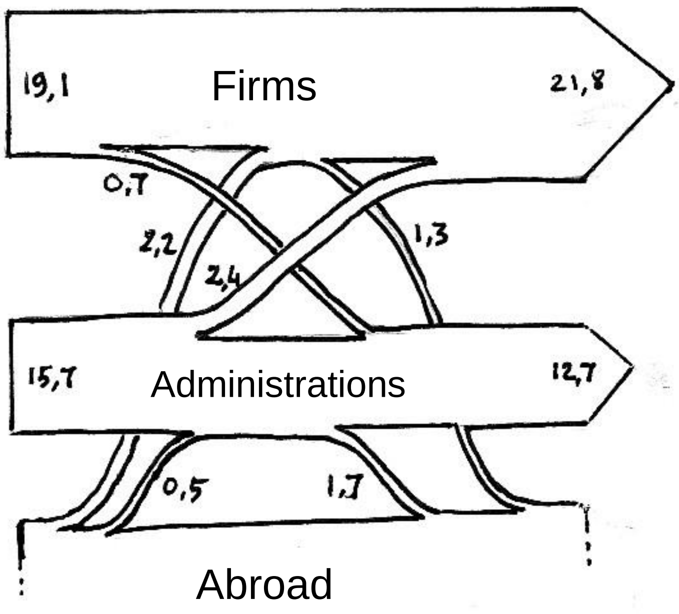
  The elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge (…) and are either located within or rooted inside the borders of nation states.
- Nelson 1993

  The national institutions whose interactions determine the innovative performance (…) of national firms
- Patel, Pavitt 1993

  The national institutions, their incentive structures, and their competencies, that determine the rate and direction of technological learning in a country.

Flows of financing and performance of R&D
The case of France (2002)

Billion Euros



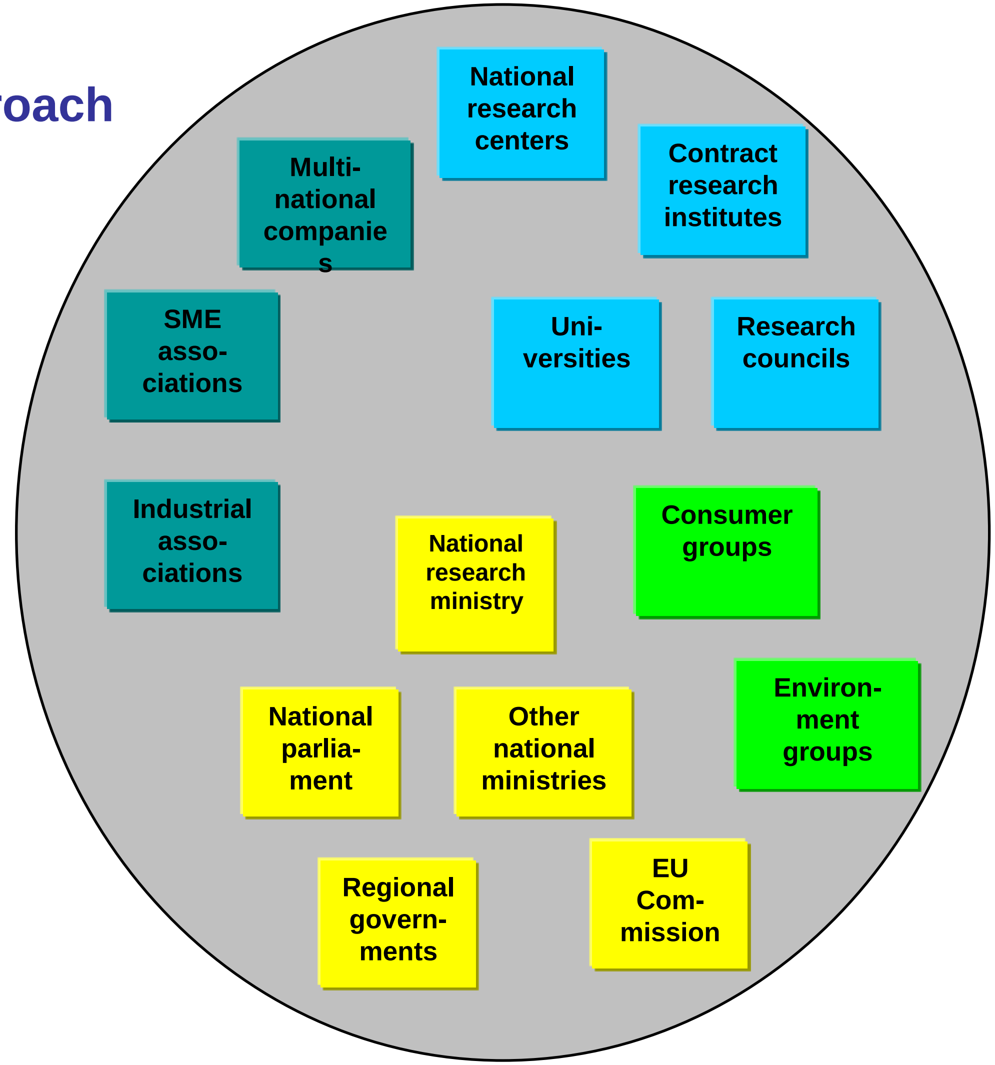
Total financing of national R&D expense: 34,8 G€ (2,28% GDP)
Total R&D performance: 34,5 G€ (2,26% GDP)

Source: MENESR-DEPB3, April 2005

A more socio-political approach of innovation systems:

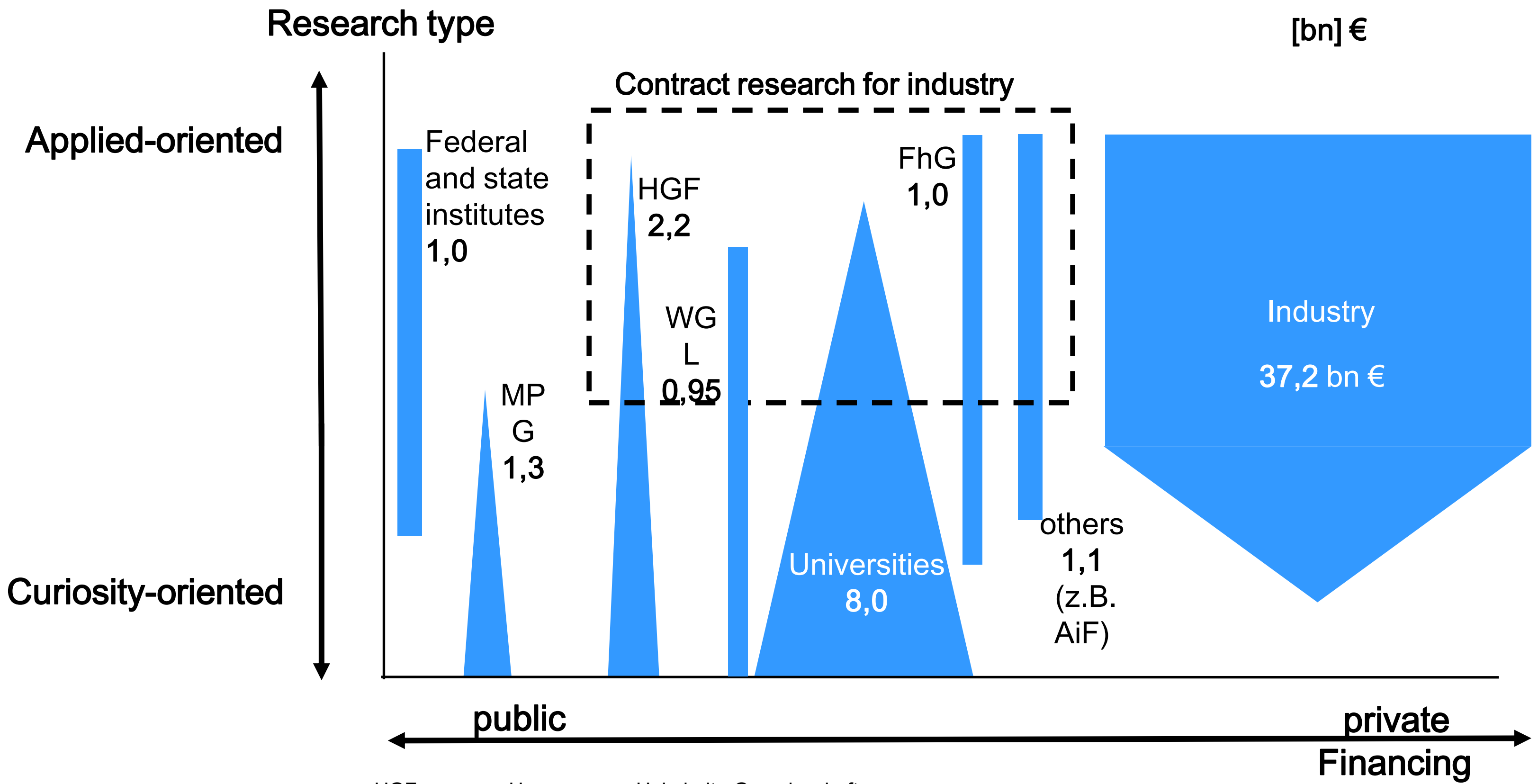
Public research and innovation policy stakeholders' arena

- Differing interests, perspectives and values
- No dominant player?
- Contested policies
- Need for consensus?



Source: Stefan KUHLMANN, Fraunhofer ISI,,Karlsruhe, & Univ. Utrecht
PRIME Conference, Manchester, Jan. 2005

Research Landscape (2001): *Institutions and Functions*
The case of Germany



HGF Hermann von Helmholtz-Gemeinschaft
WGL Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz
AIF Arbeitsgemeinschaft industrieller Forschungsvereinigungen
MPG Max-Planck-Gesellschaft

Source: Stefan KUHLMANN, FhG-ISI

National innovation systems: The case of France

Organisation of the French public research system

Many organisms with:

- **different missions (research, funds allocation, strategical choices, evaluation of research,…)**
- **different modes of management,**
- **and acting under the heading of different bodies**

  - **82 universities (teaching + various involvment in research)**
  - **approximatively 80 HE institutions, including *Grandes Ecoles* with some research activities**
  - **9 Public Research Organisations (PRO), mainly or significantly oriented towards basic research, called EPST (CNRS, INSERM, CEMAGREF, INRIA, INRA, INRETS,…)**
  - **about 15 PROs mainly oriented towards applied research and commercialization, called EPIC (CEA, CNES, IFREMER, ADEME, ANVAR, ADIT, BRGM,…) and of which only 5 are under the (co-)authority of the Ministry of Research**
  - **a large number of Technical Centers (sector oriented) and Technologies Resources Centers (often regionally based)**
  - **a lot of different foundations and organisations (Institut Curie, Institut Pasteur...) but very few big ones**

The public research system in France

Etablissements Publics à Caractère Scientifique et Technique (EPST)

CNRS	Centre National de la Recherche Scientifique
CEMAGREF	Centre d'Etudes sur le Machinisme Agricole, le Génie Rural, les Eaux et Forêts
IGN	Institut Géographique National
INED	Institut National d'Etudes Démographiques
INRA	Institut National de la Recherche Agronomique
INRETS	Institut National de Recherche sur les Transports et leur Sécurité
INRIA	Institut National de Recherche en Informatique et Automatique
INSERM	Institut National de la Santé et de la Recherche Médicale
IRD	Institut de Recherche sur le Développement (anciennement ORSTOM)
LCPC	Laboratoire Central des Ponts et Chaussées

Etablissements Publics à caractère Industriel et Commercial (EPIC)

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
ANDRA	Agence Nationale pour la Gestion des Déchets Radioactifs
ANVAR	Agence Nationale pour la Valorisation de la Recherche
BRGM	Bureau de Recherche Géologique et Minière
CEA	Commissariat à l'Energie Atomique
CIRAD	Centre de Coopération Internationale en Recherche Agronomique p le Dévpt
CNES	Centre National d'Etudes Spatiales
CSTB	Centre Scientifique et Technique du Bâtiment
IFP	Institut Français du Pétrole
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
INERIS	Institut National de l'Environnement Industriel et des Risques
IRSN	Institut de Radioprotection et de Sûreté Nucléaire
ONERA	Office National d'Etude et de Recherche Aérospatiale

Etablissements publics à caractère administratif (EPA)

Collège de France
Institut Curie
Institut Gustave Roussy
Institut Pasteur
Muséum National d'Histoire Naturelle
Institut National de Recherche Pédagogique
Centre d'Etude de l'Emploi

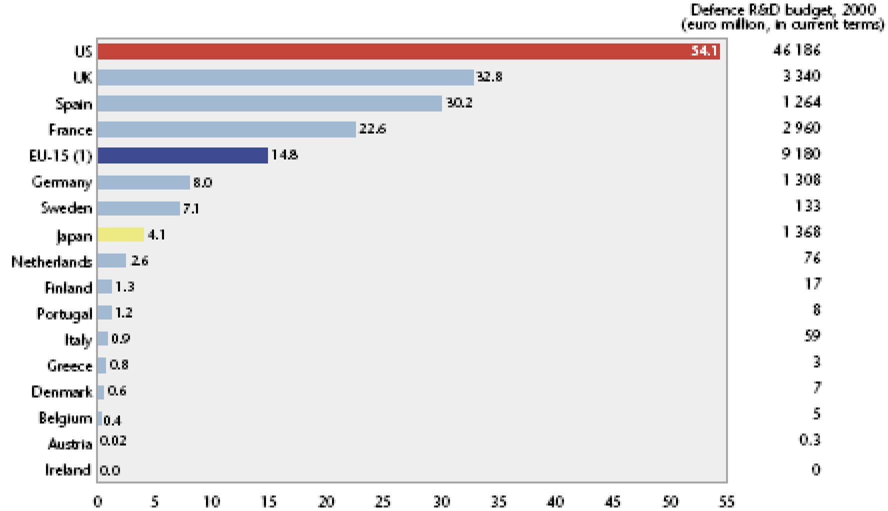
Laboratoires académiques : Universités, Grandes Ecoles
Etablissements publics de recherche exécutant principalement de la recherche sur crédits militaires

Public R&D expenses

(2001)

Public research organisms: EPST	29%
Public research organisms: EPIC	27%
Universities & *Grandes Ecoles*	36%
“Not for profit” organisations	4%

Figure D1.2.2 Government R&D budget – defence R&D as % of total GBAORD, 2000



Source: DG Research
Data: Eurostat (NewCronos), OECD
Note: (1) L data are not included in EU-15 average.

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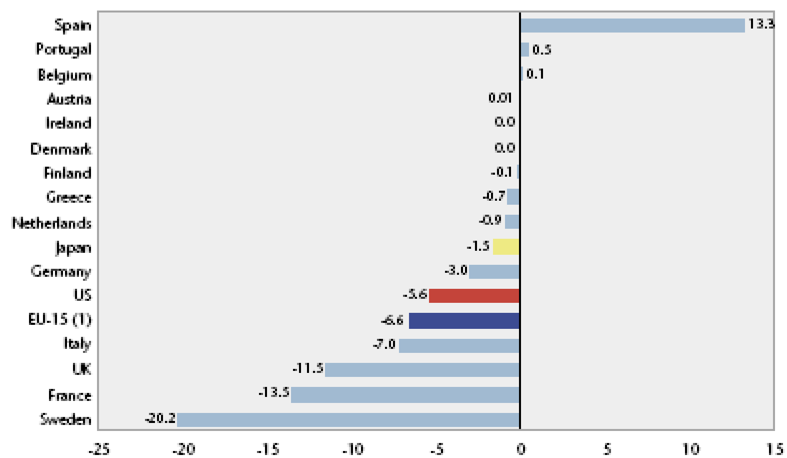
Figure D1.2.3 Defence R&D budget – change in the share (percentage points) of total GBAORD, (1991-2000)



Source: DG Research
Data: Eurostat (NewCronos), OECD
Note: (1) L data are not included in EU-15 average.

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Funding of the French public R&D

(2001, MEuros)

R&D civilian budget	7340	50%
Ministry of Education for universities	2880	20%
Ministry of defense	2403	17%
Other ministries	453	3%
Regions	152	1%
Non profit org.	236	2%
Organisms' self-financing	686	4%
Contribution of the state to European Framework Programmme	529	3%
TOTAL	**14678**	**100%**

the R&D investment of European top international R&D performers in comparison to that of the US and in selected sectors. In comparison to the very large firms the SMEs are a very heterogeneous group that needs to be taken into account when targeting policies.

Section 5 analyses the development of the venture capital investment (in seed, start-up and expansion phases) across the countries and across stages. In particular, the investment by stages in the high-tech and non-high-tech sectors is seen as an indication for venture capital's role in creating R&D performers and new business sector R&D investment in the emerging knowledge-based economy.

Finally, this chapter closes with a dossier about the results of a case study concerning the creation of science-based spin-offs which are an important mechanism for commercialisation of the research results and which obviously require a coherent financing and knowledge support system.

SECTION I FINANCING OF R&D ACTIVITIES: THE ROLE OF THE BUSINESS SECTOR

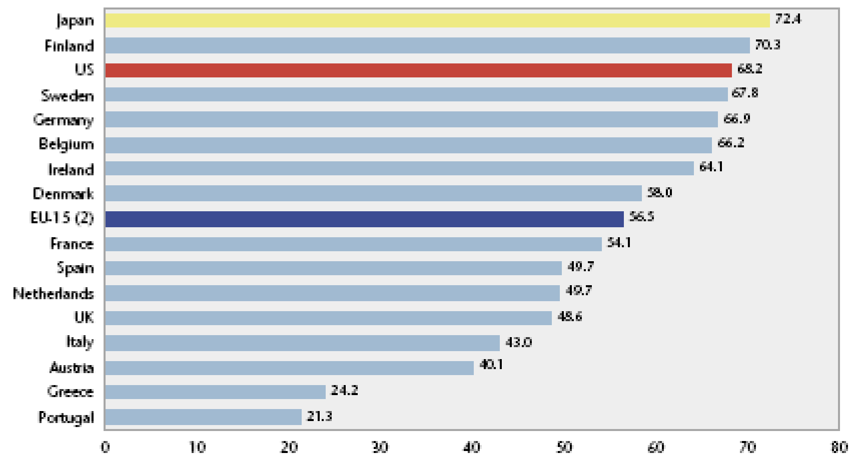
1. R&D activities financed by the business sector

Business sector R&D financing of Gross Domestic Expenditure on R&D (GERD)

The objective of research activities financed by business enterprise is to increase future profitability and competitiveness. These activities do not have to be conducted within the business sector alone, but can be carried out in the government sector, higher education sector or in other sectors as well. Such research executed outside the business sector probably includes research activities that are not normally conducted in the business sector, such as basic research, or that which is complementary to the sector's own research and development (R&D) efforts.

In the EU, the business sector is the major source of financing for total R&D (GERD) in the late 1990s. In this period, however, its share amounted to 56.5%, which ranks con-

Figure 3.1.1 Share of Gross Domestic Expenditure on R&D (GERD) financed by industry (%), 1999 or latest available year (1)



Source: DG Research
Data: OECD
Notes: (1) I: 1996; E, FIN, US, JP: 2000; D, A: 2001. (2) EU-15 calculated by DG Research; L not included.
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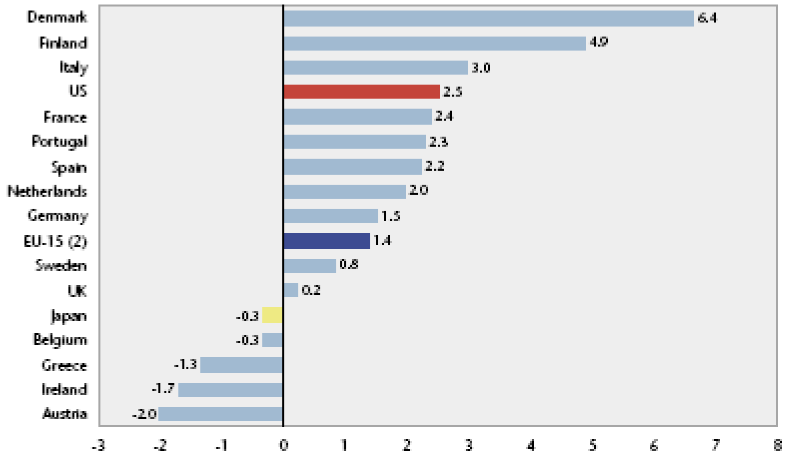
Figure 3.1.2 Share of Gross Domestic Expenditure on R&D (GERD) financed by industry – average annual growth (%), 1995 to latest available year (1)



Source: DG Research
Data: OECD / Eurostat
Notes: (1) I: 1995-1996; JP: 1996-2000; F: 1997-1999; FIN: 1998-2000; E, US: 1995-2000; D, A: 1995-2001; all other countries and EU-15: 1995-1999. (2) EU-15 calculated by DG Research; L not included.

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siderably behind the US (68.2%) and Japan (72.4%). There are considerable differences in the business sector financing of GERD across the Member States, indicating structural differences in financing the system of knowledge production. In particular, in Belgium, Ireland, Finland, Sweden, Germany and Denmark the shares are comparable with those of the US and Japan. In contrast, in Portugal and Greece the share is extremely low at just above 20% (figure 3.1.1).

In the US, the relative importance of the business sector in financing GERD is not only considerably higher in 2000 but has also increased by 2.5% more than in the EU. In the second part of the 1990s this share has grown only slightly in the EU, implying that there are no radical changes of the knowledge production system in this respect. In Japan it has, contrary to the situation in the EU and the US, declined, although the Japanese share is still slightly higher than in the US.

In particular, the dynamics of GERD financed by industry differ strongly across the Member States. Portugal, Spain and France are catching up with relatively high growth rates from initially low levels. In contrast, Austria and Greece are falling further back as they have negative dynamics at a low level of GERD financed by industry. Other countries - Ireland, Belgium and Japan - also have negative growth rates but are starting from a high initial level. Finland and also Denmark show strong positive dynamics at a high initial share of GERD financed by industry while in Sweden and the UK the trend is increasing only slightly (figure 3.1.2).

R&D activities of other sectors financed by industry: utilisation of other sectors' knowledge pool

The business sector's financing of research activities in other sectors reflects industry's strategy to utilise the knowledge pool and competencies outside of the business sector, such as in the public sector and higher education. The existence of such a pool provides a strategic benefit for the firms, provided that the business sector has appropriate absorptive capacities for the utilisation of the research results.

The share of government expenditure on R&D financed by industry reflects the links and co-operation between science and industry. In some Member States, for example the UK (21.1%) and the Netherlands (20.4%), such co-operative efforts are very intensive. In comparison to the EU average (8.8%) this is also the case, although to a lesser extent, in Ireland (16.5%), Finland (14.2%) and France (10.8%) (figure 3.1.3).

National innovation systems: international comparisons

Comparing financing/performing flows of R&D: France *vs* Germany

FRA 2002 (37,5Mrds €)	Firms	Adm.	Abroad
Firms	17,1 (46%)	0,7 (2%)	1,3 (3%)
Adm.	2,4 (6%)	11,6 (31%)	1,7 (5%)
Abroad	2,2 (6%)	0,5 (1%)	

ALL 2001 (53,9Mrds €)	Abroad	Adm.	Abroad
Firms	32,9 (61%)	1,2 (2%)	1,2 (2%)
Adm.	2,4 (4%)	13,8 (26%)	1,1 (2%)
Abroad	0,9 (2%)	0,4 (1%)	

Financing: from row to column

There are certain reasons behind the Japanese government's increased contribution to R&D activities. In the mid-1990s, Japan initiated numerous new measures in its first Science and Technology Basic Plan (1996–2000) in order to encourage investment. In March 2001, the Japanese government decided on the basic lines of the second-term Basic Plan (2002–2006). This plan directed attention to the measures that had already been launched in the first plan. For one thing, it was decided to increase competitive funds, subject to the selective and efficient allocation of resources. There was also more emphasis on the development of relations between industry, academia and the government (MEXT, 2001; see also OECD, 2000; Polt et al., 2002). In addition to the Basic Plan, the Ministry of the Economy, Trade and Industry has recently brought in measures to reform the innovation system, and to enhance the (joint university-corporate) commercialisation of research, for instance (METI, 2002). The Ministry also invests in the four priority fields of research (life sciences, information technology, environmental sciences, and nanotechnology and materials), all of which offer high potential for commercialisation.

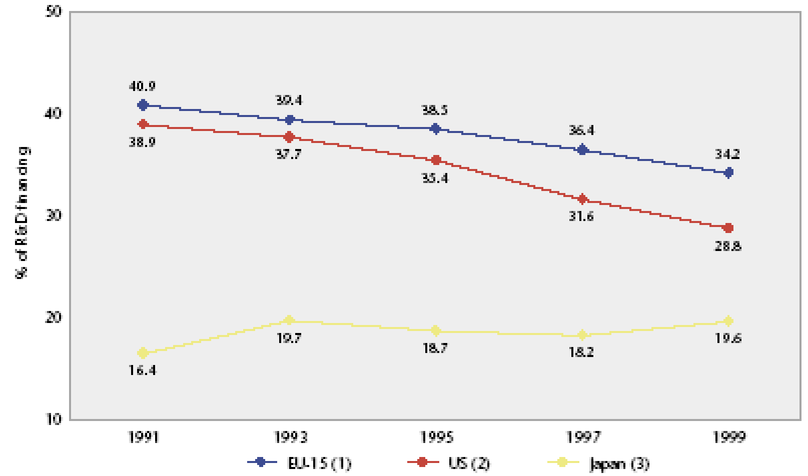
Figure 2.2.3 shows the share of government in total R&D financing. The public sector in the EU accounts for a larger proportion of R&D financing than in the US or Japan. In 1991, the public sector accounted for 41% of total R&D financing in the EU, while the figure for Japan was 16%, and the US 39%. During the 1990s, the situation in the EU and the US changed considerably. In 1999, the public sector accounted for some 34% of total R&D financing in the EU. The figures for Japan and for the US were 20% and 29%, respectively. Thus, while the public sector share of total R&D financing decreased significantly in the EU (by 7 percentage points), the decline was even more substantial in the US, where the public sector share decreased by 10 percentage points during the decade. In the periods 1991–1993 and since 1997, the trend in Japan was the opposite to that of the EU and the US.

Figures in the US were fairly close to those of the EU throughout the 1990s. However, government's share of total R&D financing in 1999 represented the largest distinction between the EU and the US in this decade: the difference increased from two percentage points in 1991 to over five percentage points in 1999 (figure 2.2.3).

While government's share has decreased continuously in the EU and the US, the role of other sources of financing – especially that of the business sector – has increased significantly (figure 2.1.10). In the US, this shift has been more marked than in the EU.

In 1999, government financing of R&D in relation to GDP was the highest in the US (0.8%) (figure 2.2.4). The figures for the EU and Japan were 0.7% and 0.6%, respectively. In

Figure 2.2.3 Share (%) of government in total R&D financing in the 1990s



Source: DG Research
Data: OECD; DG Research
Notes: (1) L data are not included in EU-15 average. (2) US: excludes most or all capital expenditure.
(3) JP: 1996 instead of 1995 (due to a break in series).

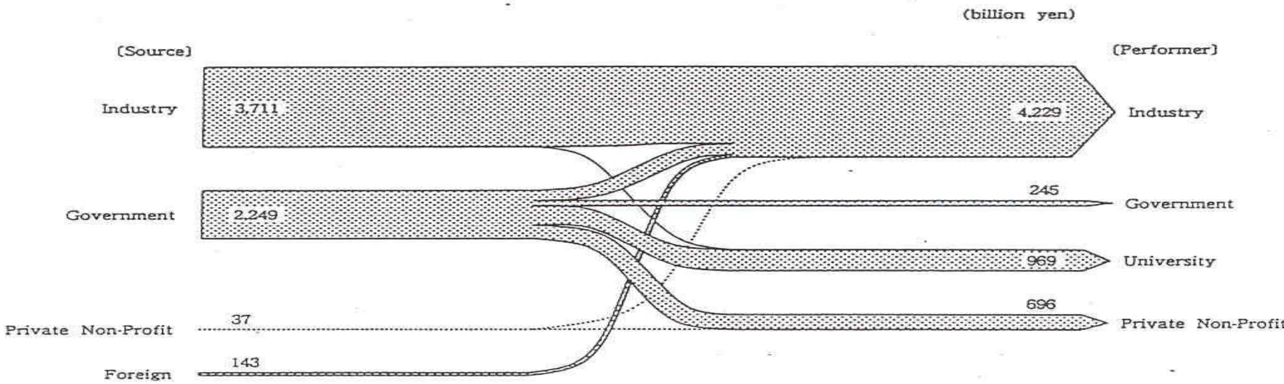
Third European Report on S&T Indicators, 2003

Year: 1992

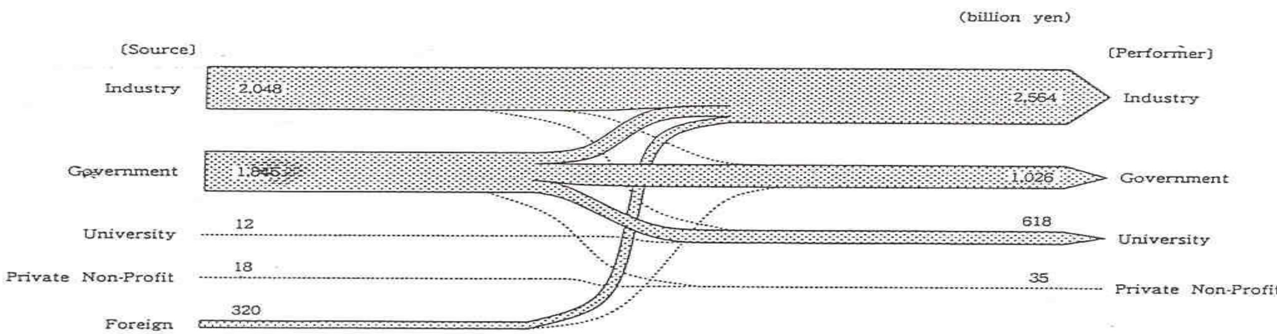
Flow of R&D Expenditure in selected Countries

(C) Germany

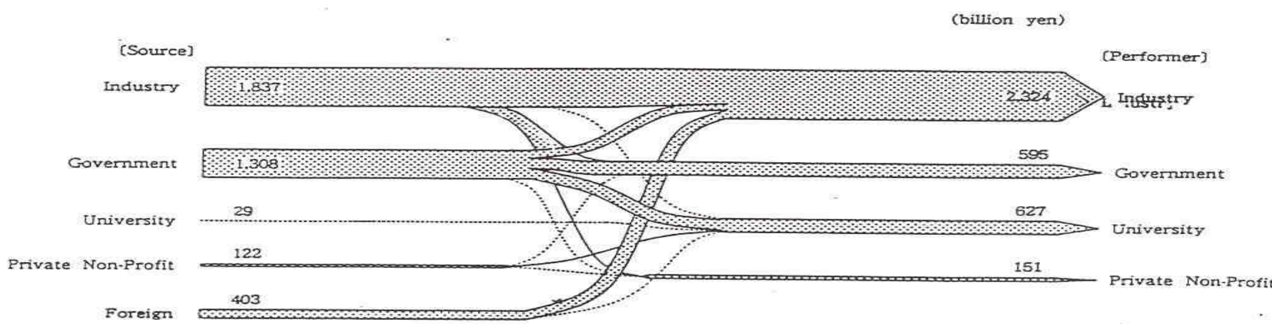
Source: NISTEP, Tokyo
(From NSF)



(D) France



(E) U.K.



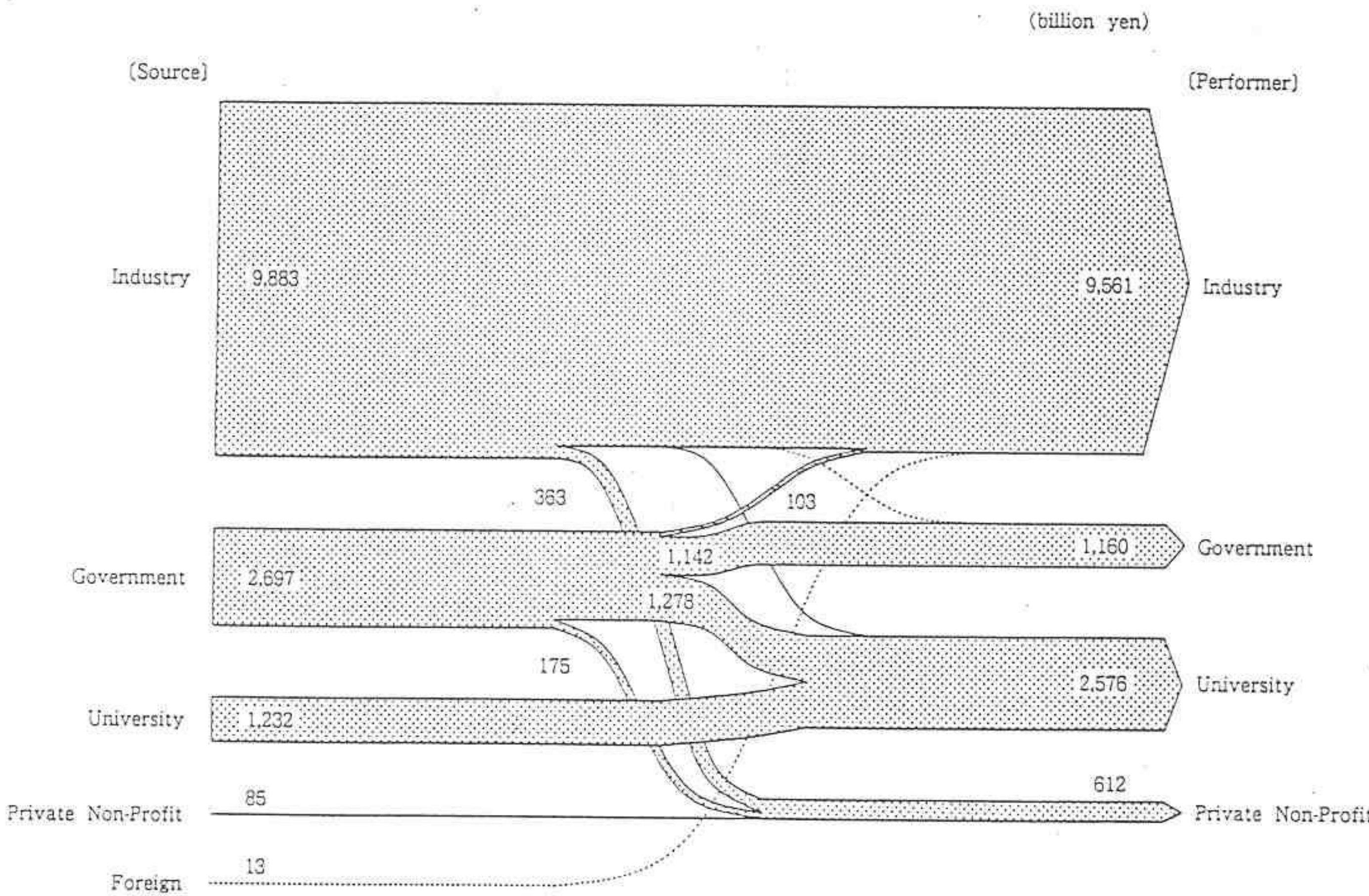
Source: NISTEP, Tokyo

Year: 1992

Source: NISTEP, Tokyo
(From NSF)

Figure 4-1-8
Flow of R&D Expenditure in selected Countries

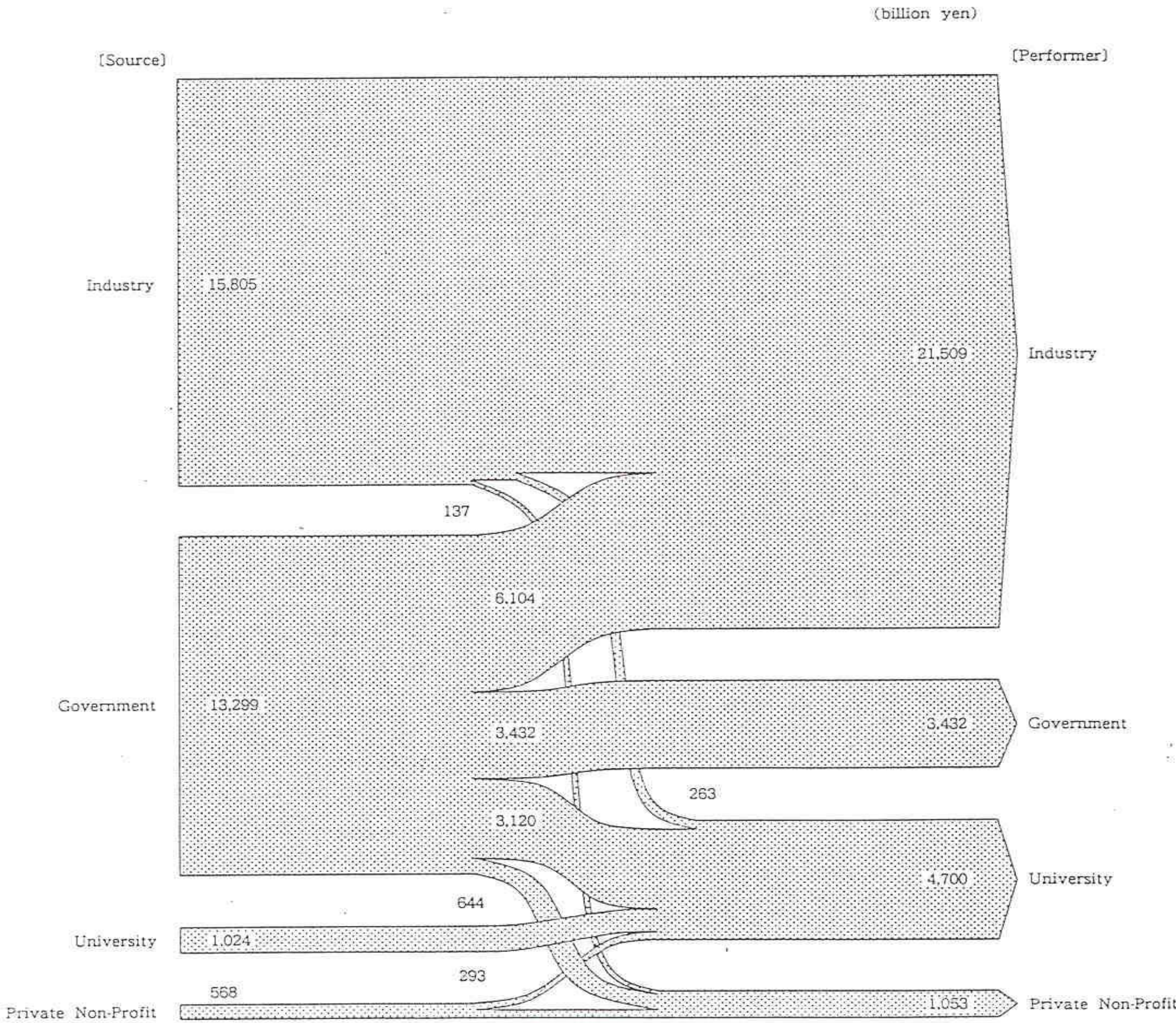
(A) Japan



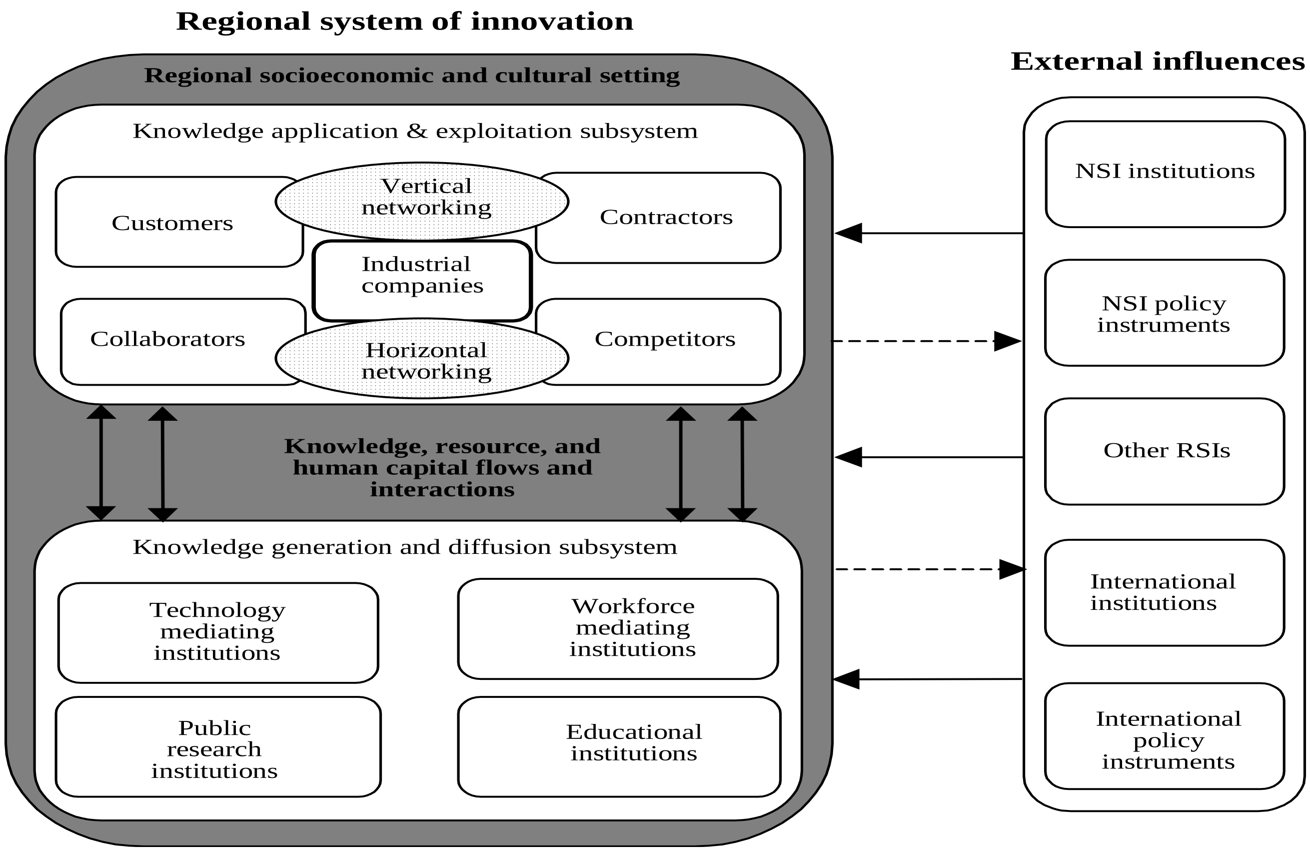
Year: 1992

Figure 4-1-8
Flow of R&D Expenditure in selected Countries
(B) U.S.

Source: NISTEP, Tokyo
(From NSF)

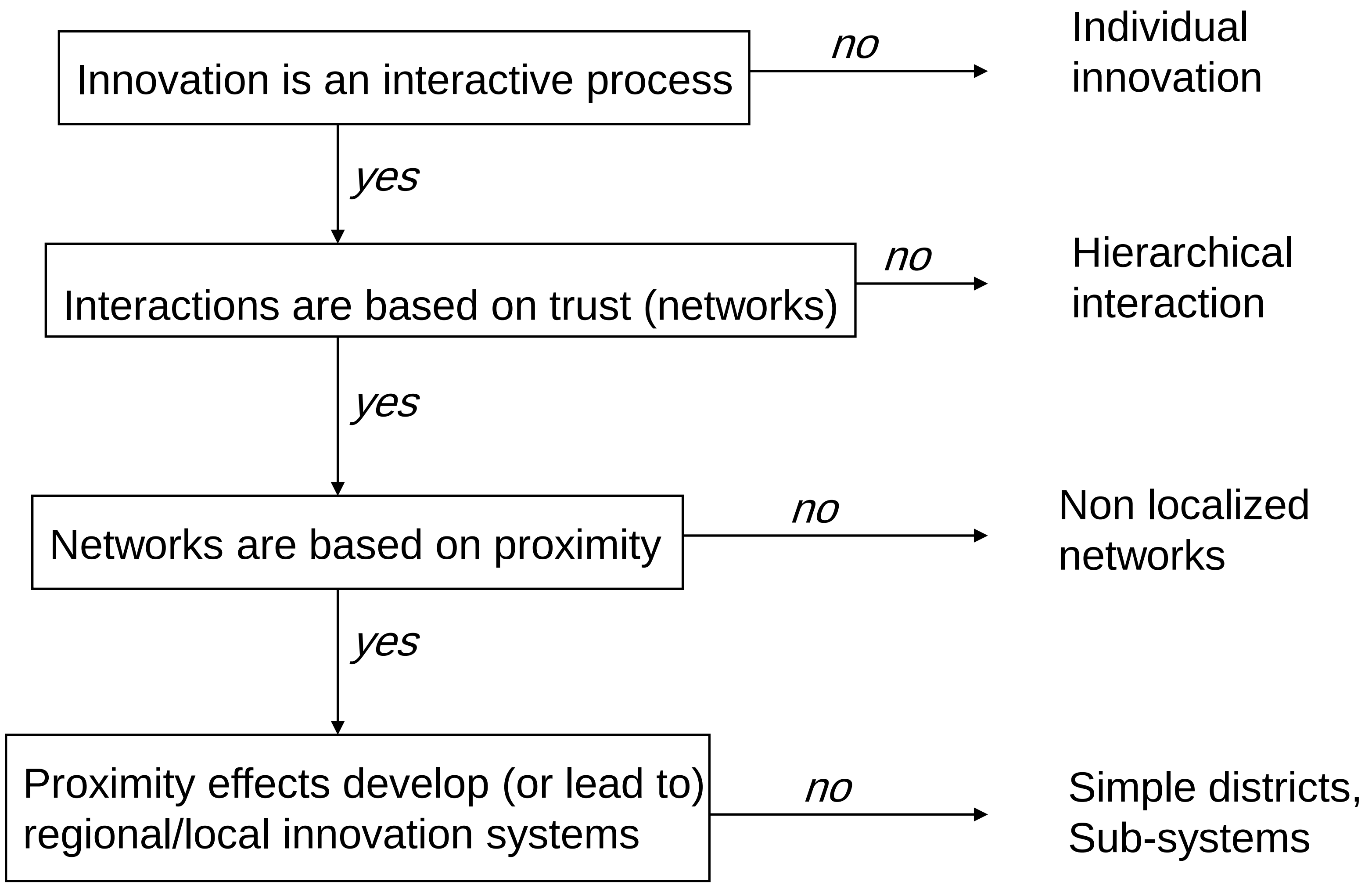


Regional innovation systems: General approach



Adapted from Autio (1998)

The territorial embeddedness of innovation process: theoretical relevance



The regional dimension

- EU explicitly considers that regional (sometimes local) level is the optimal space for organising innovation. This is a very important point (to be further explained) largely confirmed by empirical and theoretical work: concepts of *innovative milieu*, of *localized innovation system*, of *innovative cluster*, etc. Politically, it is also a way for EU to support directly the European regions (bypassing the national level) for implementing its policy.
- Decentralization of governance is also a general tendency in European countries. The trend is not limited to research and innovation policy. Even in very centralized nations like France and England, a process of decision power *devolution* towards regional administrations is ongoing or planned. Such a tendency boosts regional systems' self-organization – with the participation of regional authorities as relevant public actors. We are therefore in a context of increased territorial competition, but negotiation and co-financing with central government normally help keeping a minimum of coherence and avoid wastefull duplication.
- The administration itself is sometimes involved in a «deconcentration» process. It is typically the case in France where deconcentration of central administration comes along with decentralization. That means for example more responsability and decision capacity for *central government representatives* in regions in co-ordination with regional authorities. Another example is the larger autonomy *public universities* will have in the future for defining their own strategy. Those evolutions are important aspects of the rise of multi-level governance.

The possible contradiction between regional and innovation policies

- In the game betweeen Regional and European actors, misunderstanding can arise. To sum up, in the framework of the ERA project, EU is asking the regions the following question:

  "What do you, regions, offer to contribute to the great network of knowledge-based Europe?"

  It means implicitly: if you have nothing to offer, we can stop the discussion; if you have any asset to be considered, we will help you to develop it.

  Regions have often a long standing experience of being beneficiaries of "land planning" and other supporting operations from higher level of governance (even EU contributes, through regional funds policy, to support regions in various case of difficult situations). Such regions therefore will think:

  "What can Europe do to help developing my region?"

- To a certain extent, the new EU research policy is at odd with regional policy. The idea of *picking the winners and articulating them into a network* is apparently in contradiction with another important EU objective: regional convergence. It would not be a serious problem if research and innovation were activities among other possible specializations. But if, by hypothesis, this field is going to be essential to any economic and social development, then the policy principles of the DG Research of the EU is not acceptable for a large part of European territories.

Increased regional concentration

- There are theoretical and empirical reasons to believe that the knowledge economy leads to more concentration and inequality than the industrial economy. Industrial revolution was largely based on economies of scale. It led to geographical concentration (see Alfred Marshall's analysis of localized externalities and the formation of industrial districts like in Manchester in the 19th Century). Knowledge creation networks exploit powerful economies of variety: in areas where a large scope of complementary knowledge and competence exist, creativity is considerable and lead to ever more knowledge (in quantity and variety). Counter weighing effects (increasing price of factors, congestion) are not so efficient to expand geographically the development as in the case of classical industry.
- As a consequence, the regions of excellence will be in limited number and will trust several knowledge fields. No doubt that the British «Golden Triangle» London-Oxford-Cambridge, the greater Paris area, Munich and Frankfurt will host important nodes of various networks of excellence (in ICT, biotechnology, advanced tertiary activities, etc.). The interesting question is about most of the other regions.

Important actors and links in a *learning region*

- For multi-level governance it is important that central administration adopts a philosophy of devolution and negotiation. Devolution in terms of decentralisation for part of the public responsibilities *plus* internal deconcentration allowing good negotiation with local actors. It is also important that central administration agents could help local administration (expertise) in a climate of trust and mutual respect.

  (this point is irrelevant for federal countries like Germany: their regions are real states)

- Good interaction of actors is critical. Public policy can help by supporting specifically mixt consortia (typically university-enterprise co-operation, but also industrial co-operative research among SMEs and between large and smaller firms). Regional authorities can also organize foresight procedures in order to develop common understanding of the future and decide for common strategy between all regional actors (including the public at large).

- Some key actors of learning regions: SMEs with increased absorption capacities for new technologies; universities with increased conscience of their potential role on the territory; KIBS (Knowledge Intensive Business Services) for their « catalyst » function in the system.

Conclusion in terms of policy

- Supporting well formed regional systems to become poles of excellence in the future ERA.
- Developing interregional networks of competence and assets when these elements are scattered.
- Boosting the restructuration of regions in difficulty.

  - Regions with weak communication between actors : **no structured system**

  - **Loked-in regions:** existing system, but devoted to obsolete (low tech) technologies and products

  - **Thin regions:** the constituting elements of an innovation system do not exist

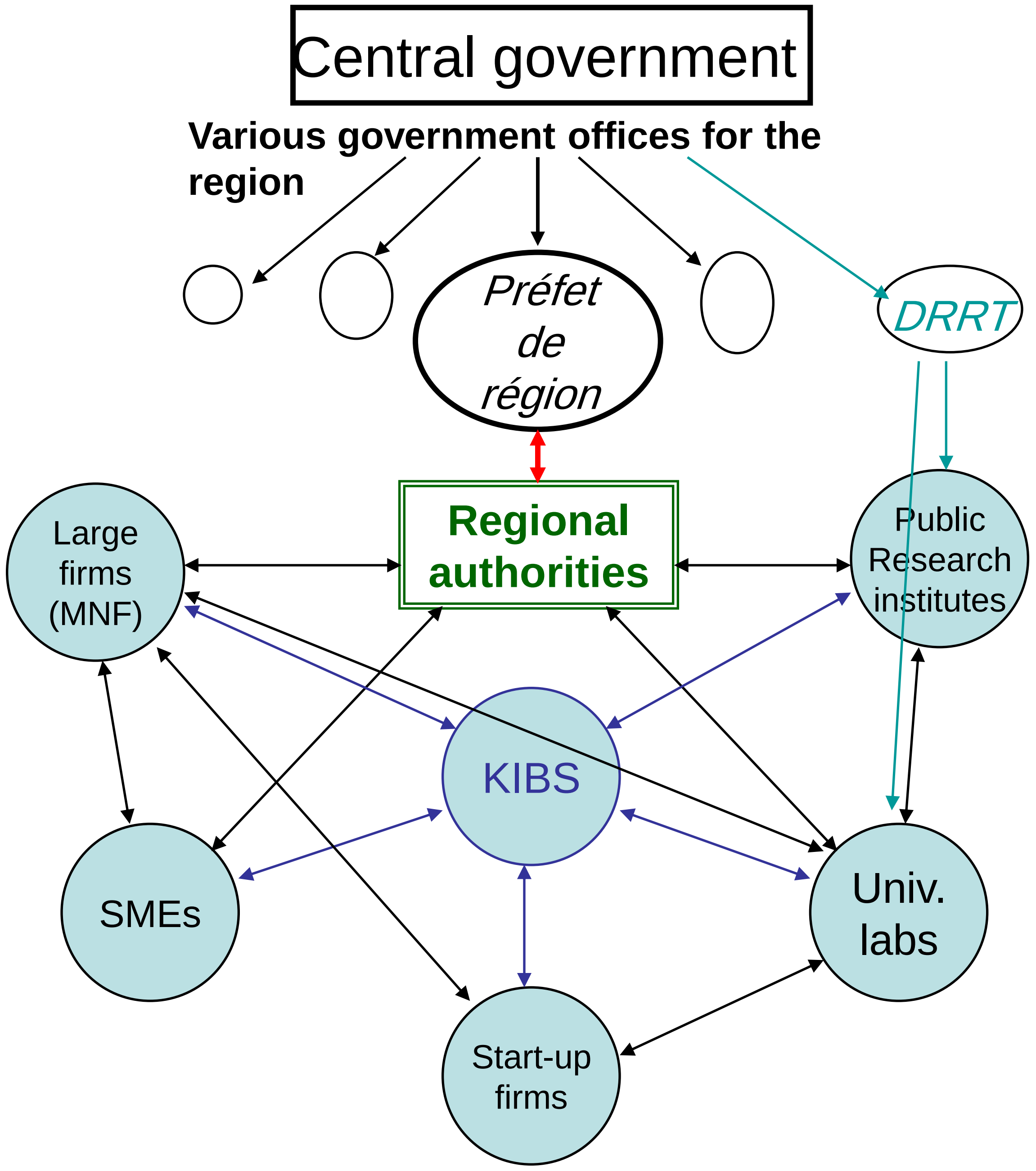
Regional innovation systems: the case of France

Decentralization of governance is a general tendency in European countries.

- The trend is not limited to research and innovation policy. Even in very centralized nations like France and England, a process of decision power *devolution* towards regional administrations is ongoing or planned. Such a tendency boosts regional systems' self-organization – with the participation of regional authorities as relevant public actors. We are therefore in a context of increased territorial competition, but negotiation and co-financing with central government normally help keeping a minimum of coherence and avoid wastefull duplication.

The administration itself is sometimes involved in a «deconcentration» process.

- It is typically the case in France where deconcentration of central administration comes along with decentralization. That means for example more responsability and decision capacity for *central government representatives* in regions in co-ordination with regional authorities. Another example is the larger autonomy *public universities* will have in the future for defining their own strategy. Those evolutions are important aspects of the rise of multi-level governance.

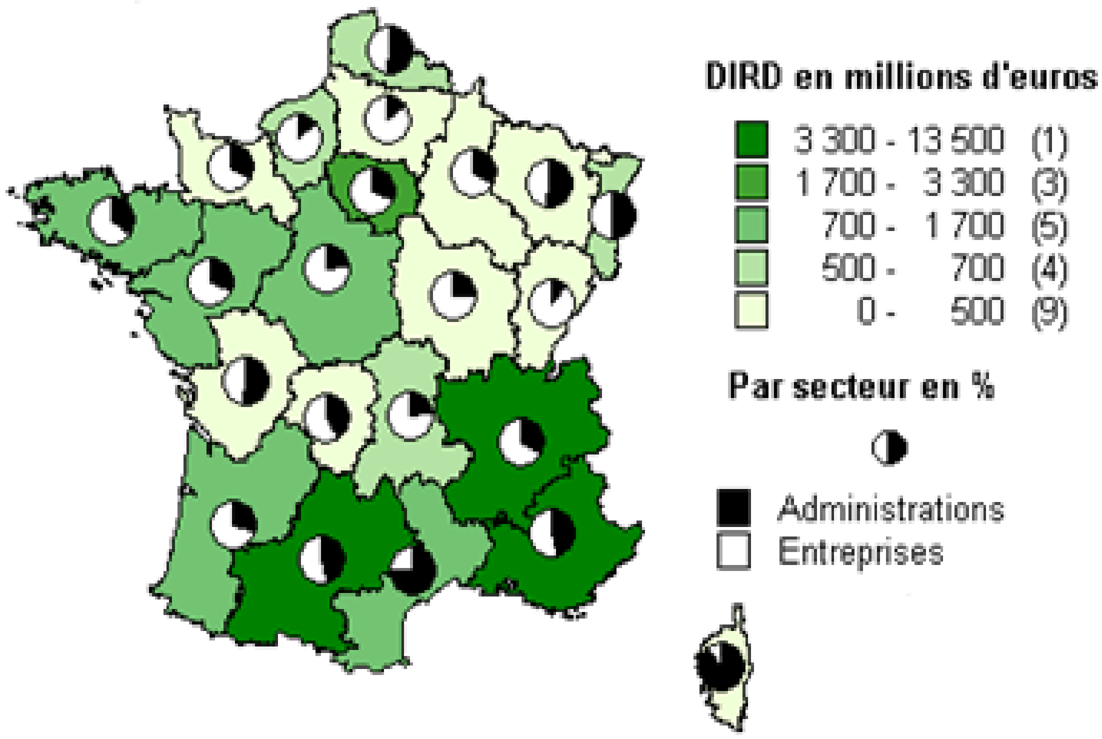

Central government
Various government offices for the region
Préfet de région
DRRT
Regional authorities
Large firms (MNF)
Public Research institutes
KIBS
SMEs
Univ. labs
Start-up firms

A rapid typology of regions in France

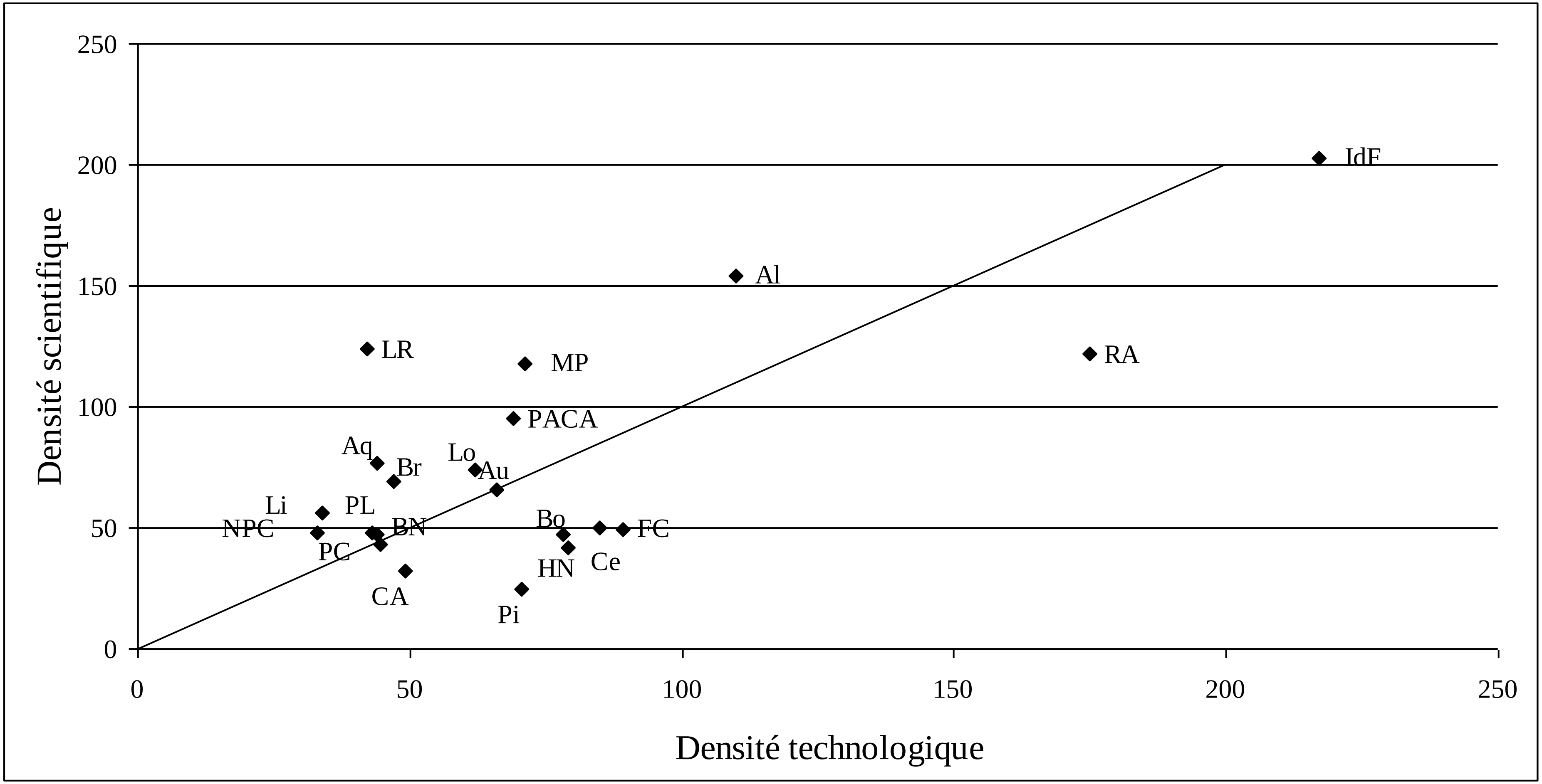
- Only two regions are bound to be complete regional systems of innovation, with real critical mass in several key technologies . Outside the **Paris** area (Region *Ile de France*), only *Rhone-Alpes* can compete in this category, with **Lyon** (life science, chemistry, materials…) and **Grenoble** (physics, nanotechnologies…) .
- Some regions exhibit *one* important innovation cluster in a specific field. The typical case is *Midi-Pyrenees*, **Toulouse** being a major European pole for aerospace.
- Most regions are not innovation systems. They are just hosting some *smaller clusters* (some companies and their sub-contractors, university and/or research centers specialized in a technological domain) or *single elements* (one good research center, one leading firm) that belong to higher level systems: *e. g.* the national system of innovation.

See OST doc

Contribution des régions à la recherche nationale en France et répartition public/privé



Dépenses intérieures de recherche et développement en 2001 (Source MJENR-DEP B3)

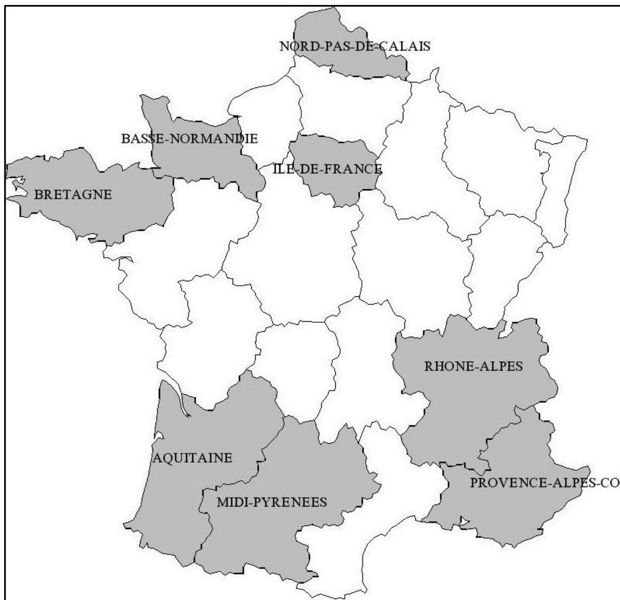


Densité scientifique
Densité technologique
250
200
150
100
50
0
0
50
100
150
200
250
IdF
Al
RA
LR
MP
PACA
Aq
Br
Lo
Au
Li
PL
NPC
BN
Bo
FC
PC
Ce
HN
CA
Pi

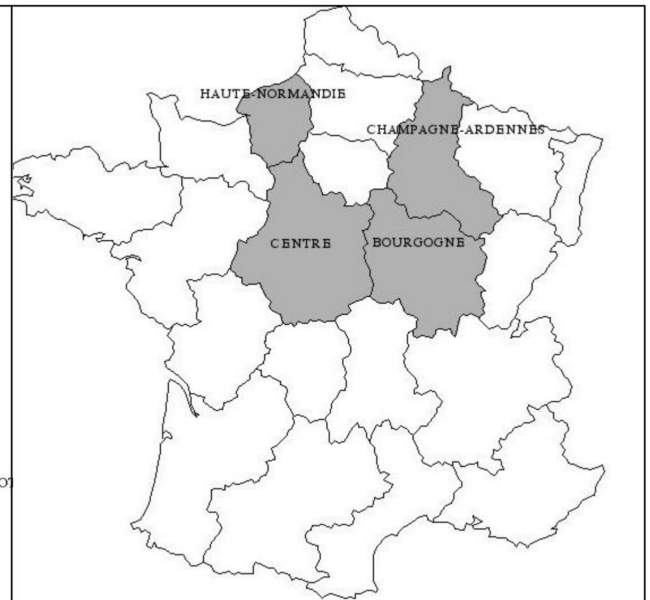
An example of innovation policy linking university and firms (1)

- Bourses CIFRE

Source: ANRT, Calculation: Rachel LEVY, BETA



Type 1 : Balanced regions

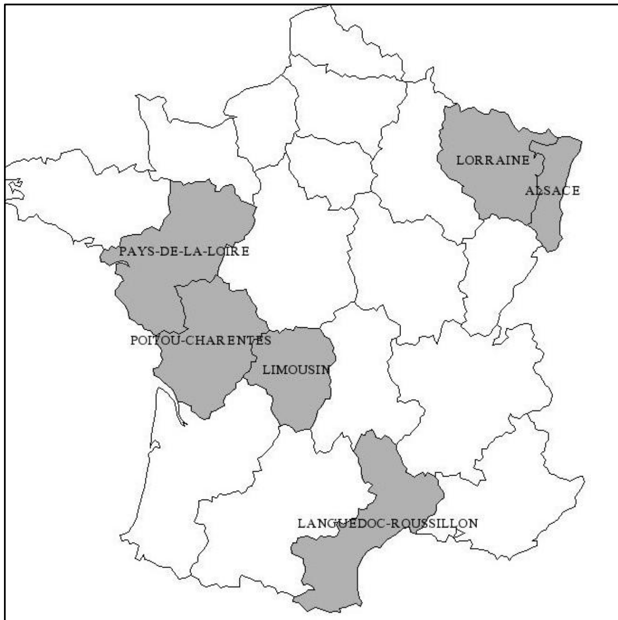


Type 2 : Importing academic competencies

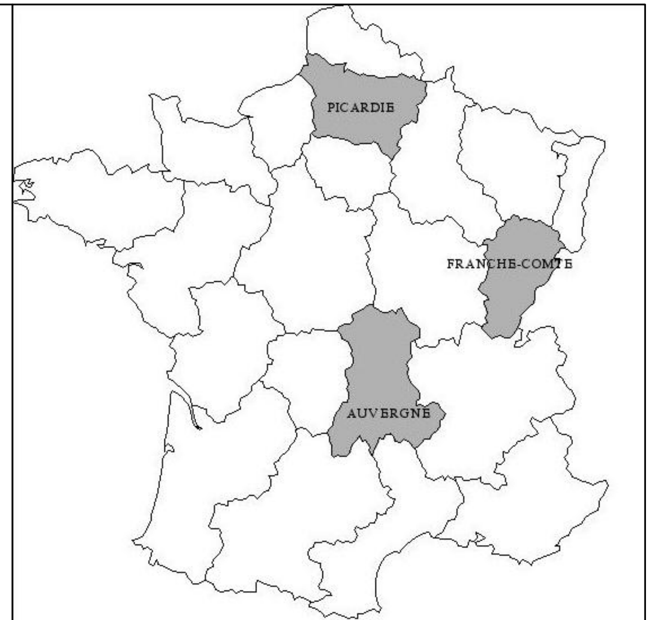
An example of innovation policy linking university and firms (2)

- Bourses CIFRE

Source: ANRT, Calculation: Rachel LEVY, BETA

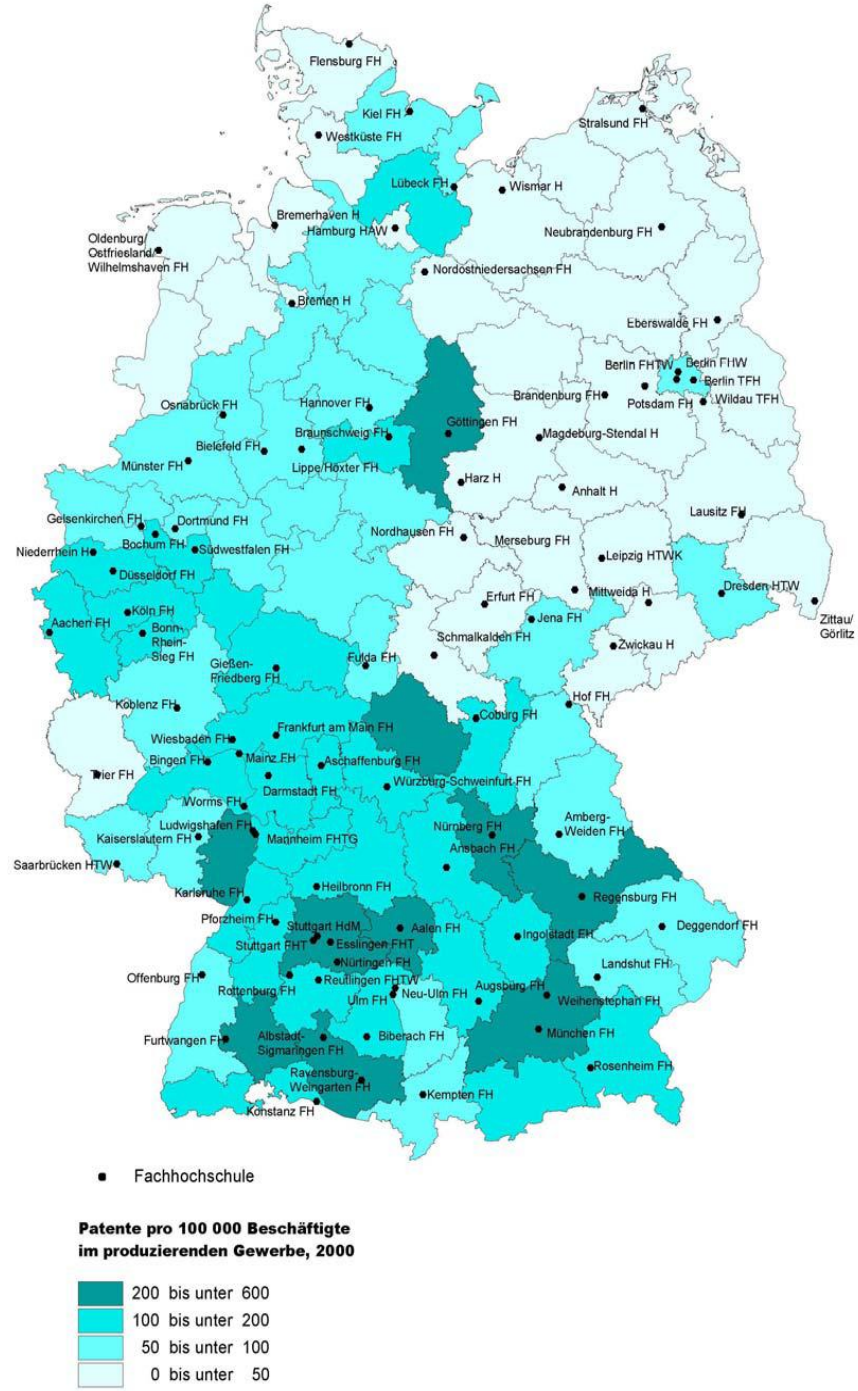


Type 3 : Exporting academic competencies



Type 4 : Less structured regions

Patents per 100,000 employees in industry (2000)

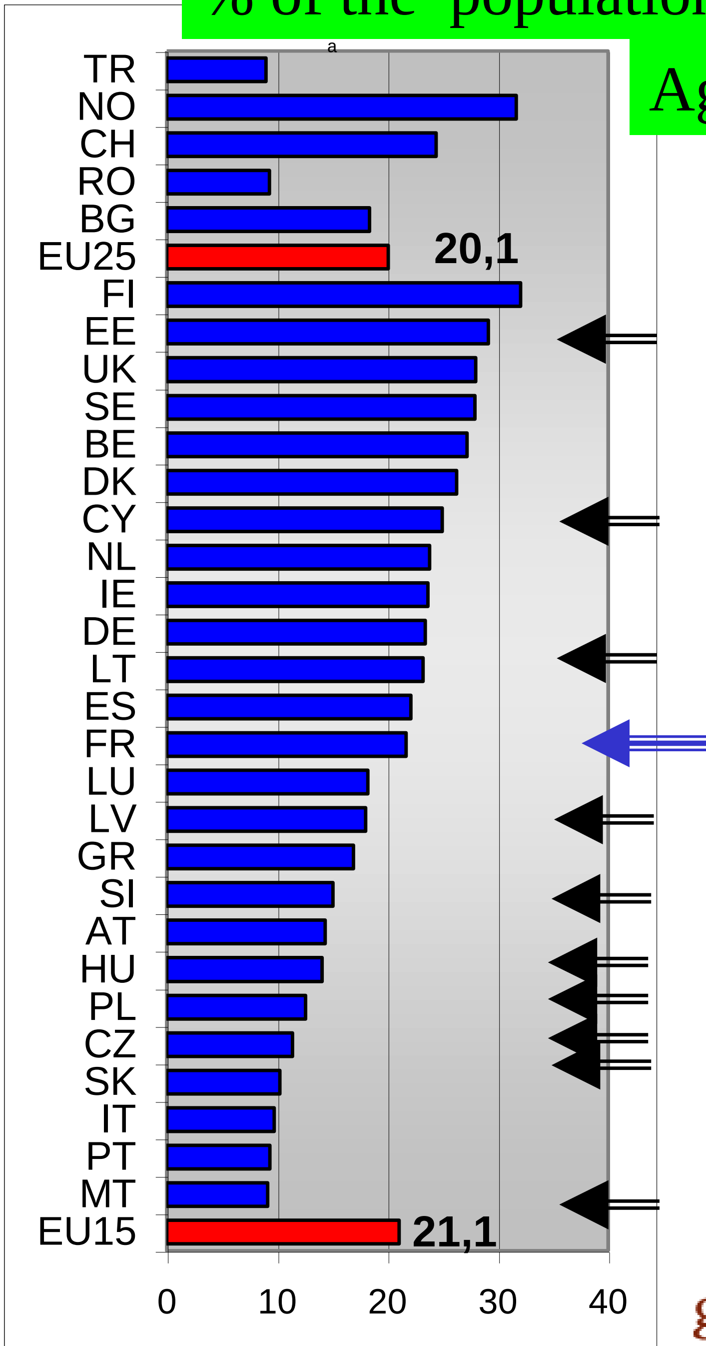


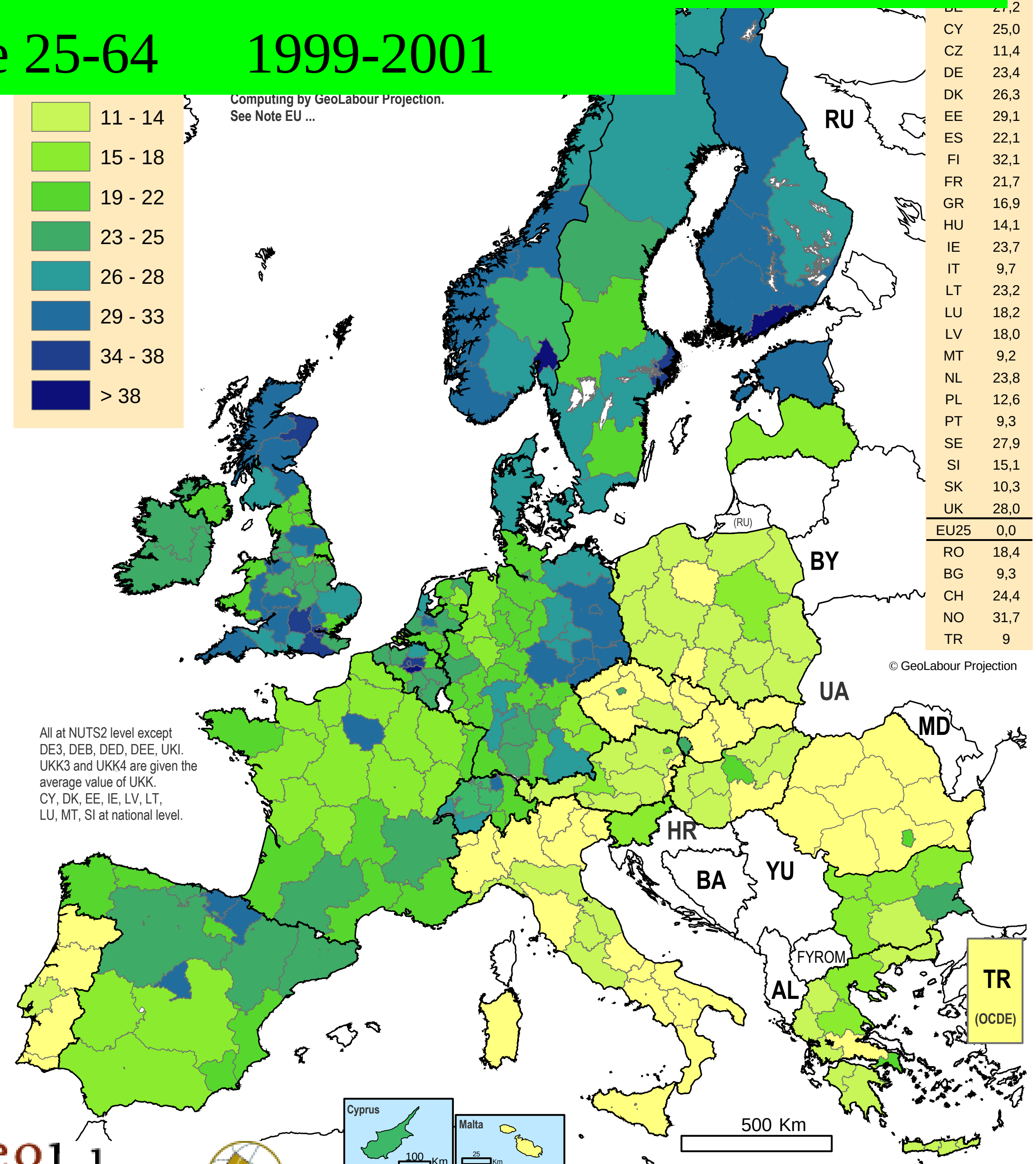
Source: Kulicke 2004, FhG-ISI, Karlsruhe

Sh_H_T03

% of the population with higher education level

Age 25-64 1999-2001





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[illegible]	[illegible],3
[illegible]	[illegible],2
CY	25,0
CZ	11,4
DE	23,4
DK	26,3
EE	29,1
ES	22,1
FI	32,1
FR	21,7
GR	16,9
HU	14,1
IE	23,7
IT	9,7
LT	23,2
LU	18,2
LV	18,0
MT	9,2
NL	23,8
PL	12,6
PT	9,3
SE	27,9
SI	15,1
SK	10,3
UK	28,0
EU25	0,0
RO	18,4
BG	9,3
CH	24,4
NO	31,7
TR	9

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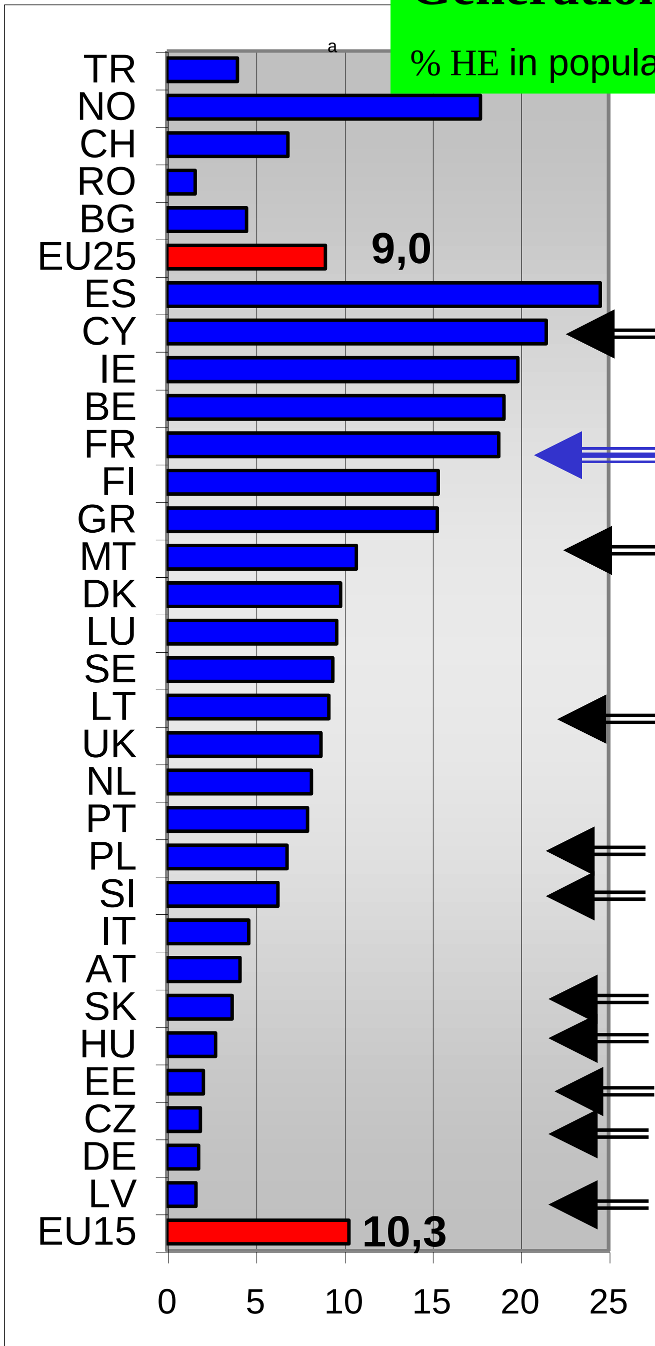
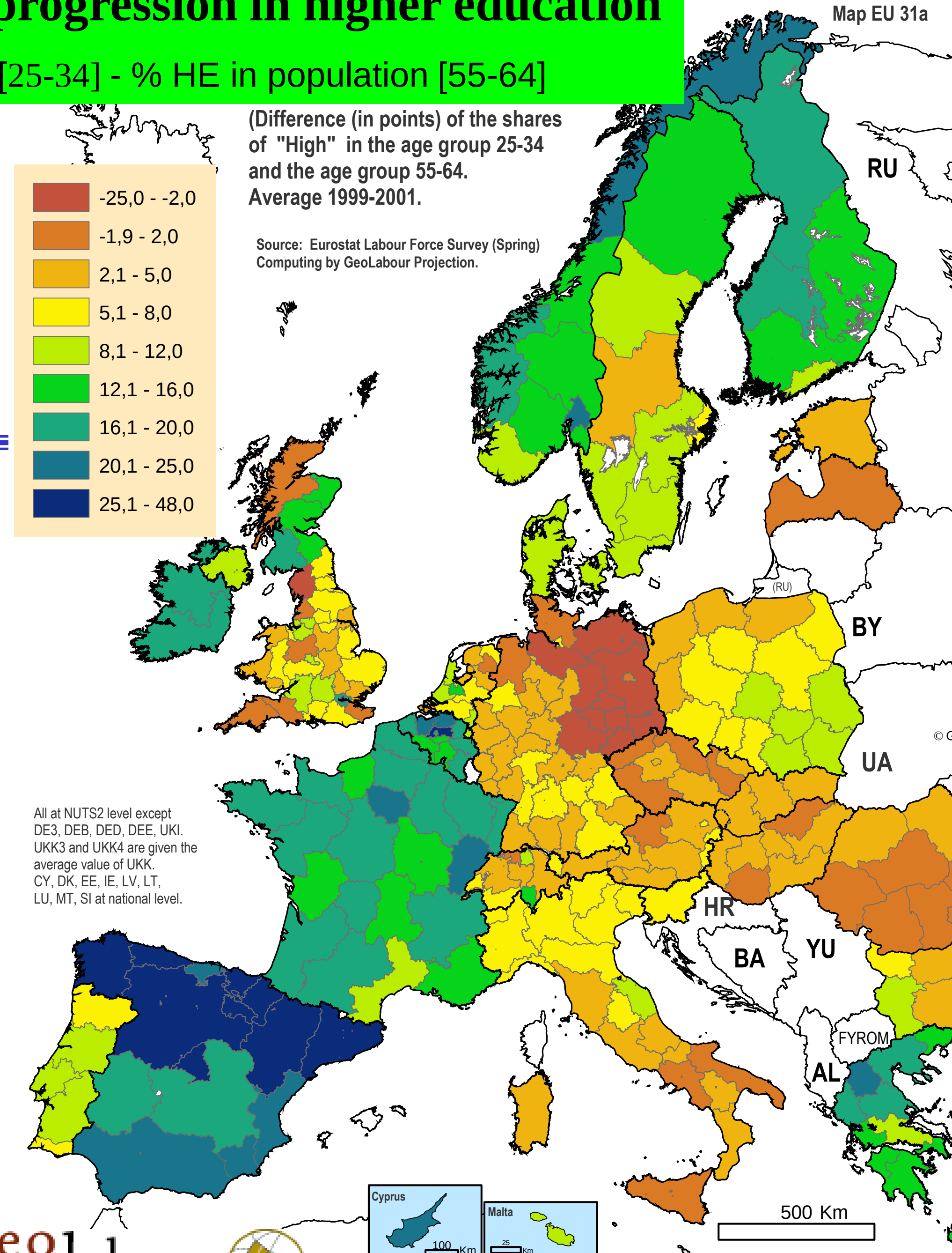
GenProH_T

Generational progression in higher education

% HE in population [25-34] - % HE in population [55-64]





EU15	10,3
AT	4,1
BE	19,1
CY	21,5
CZ	1,9
DE	1,8
DK	9,8
EE	2,1
ES	24,5
FI	15,4
FR	18,8
GR	15,3
HU	2,8
IE	19,9
IT	4,6
LT	9,2
LU	9,6
LV	1,7
MT	10,7
NL	8,2
PL	6,8
PT	8,0
SE	9,4
SI	6,3
SK	3,7
UK	8,7
EU25	6,4
RO	4,5
BG	1,6
CH	6,9
NO	17,7

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