



# Creative research environments, infrastructure and the human potential

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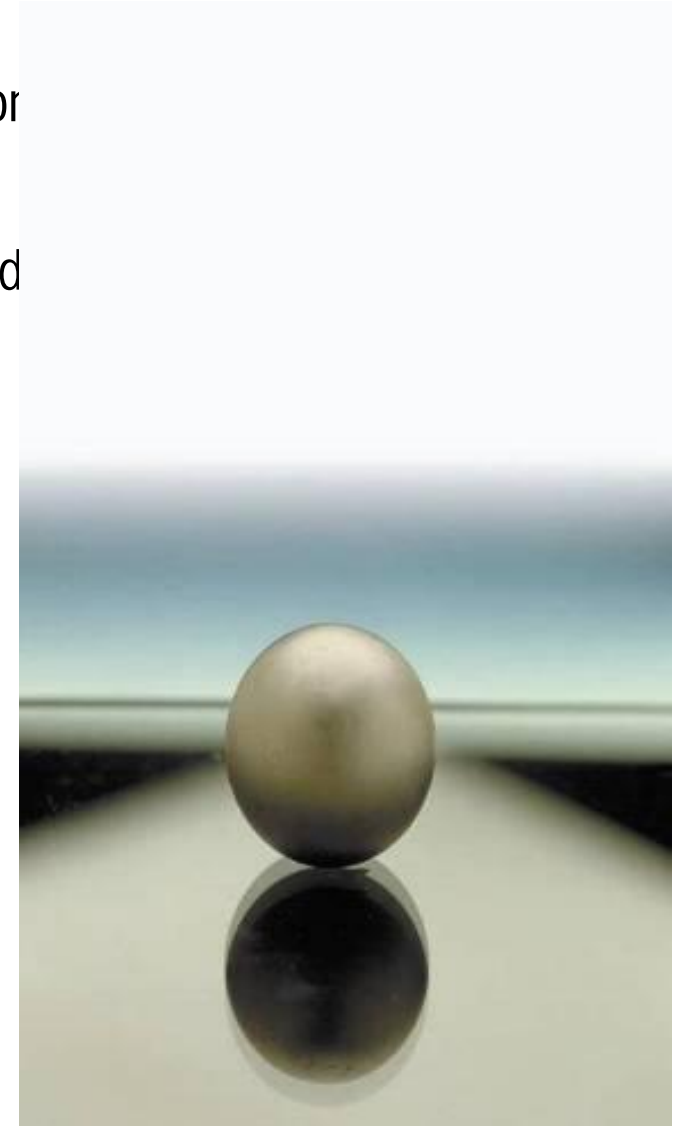
The Joint Research Centre (JRC)

Directorate General of the European Commission

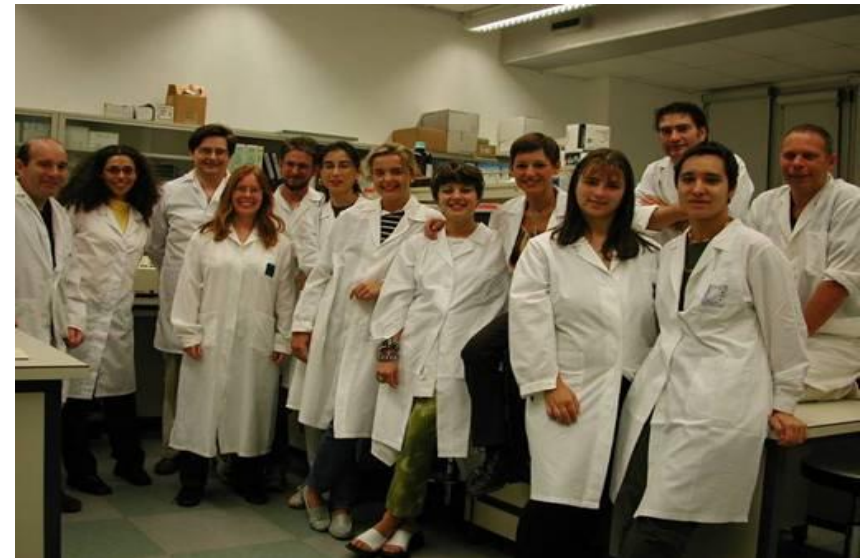
<http://www.jrc.ec.europa.eu>

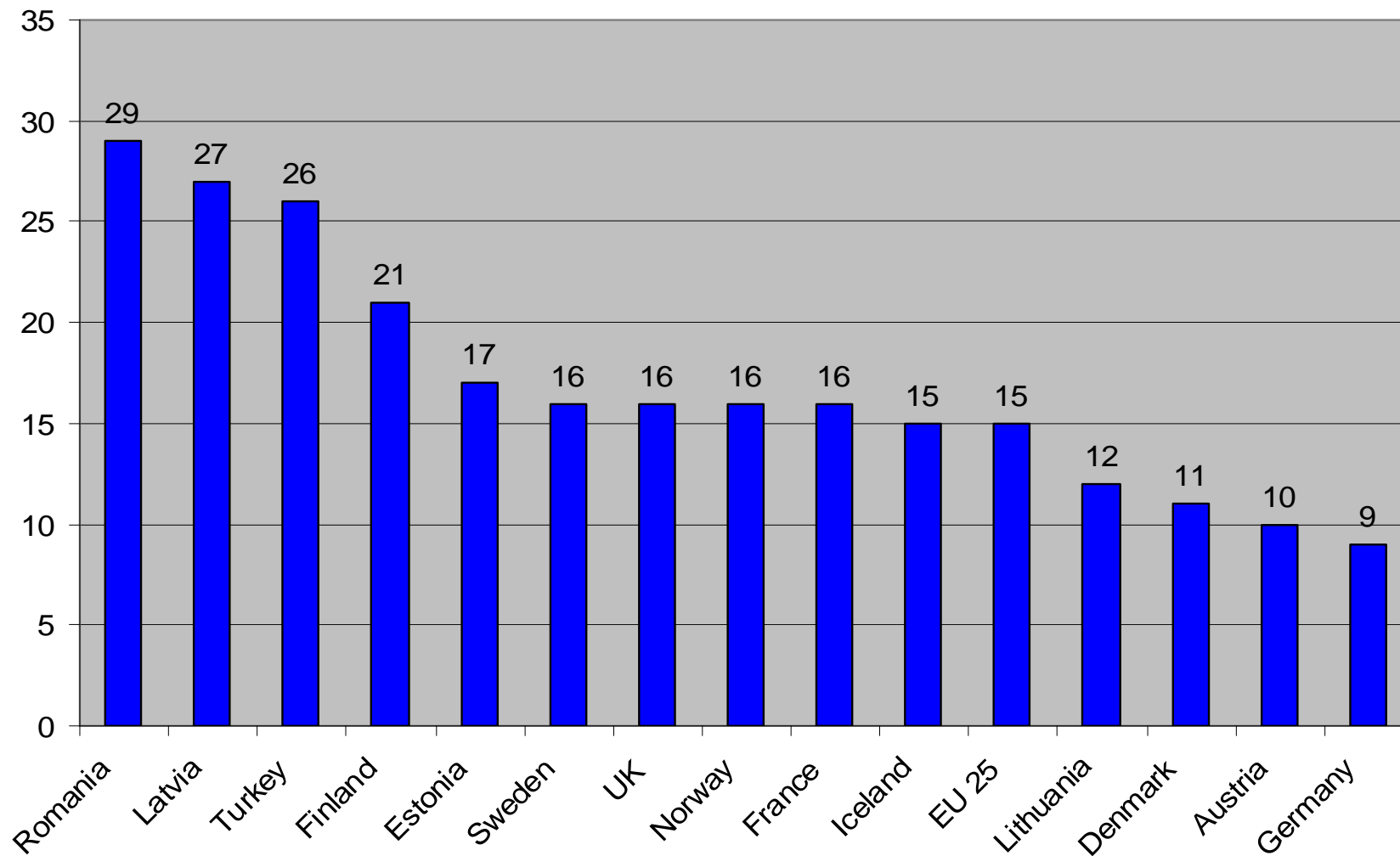
- Scientifically inspiring, challenging
- Systematic interaction, collaboration, networking between researchers and disciplines, also with the users of the results, both nationally and internationally
- Problem oriented and often interdisciplinary; traditional barriers broken
- High intellectual capacity and versatile structure: senior researchers, doctoral students, post docs, visiting researchers
- Capacity for continuous renewal, to stay at the cutting edge of research
- Forward looking, anticipating future trends, issues important for economy, productivity and welfare
- Basic and applied research may intermingle: basic research feeds ideas into practice and *vice versa*; users flexibly involved at various stages
- Do not usually evolve following administrative boundaries, may be a combination of research from several departments, or even different organisations

- A creative research environment may evolve around an innovative top researcher with management and organisational skills
- Research groups in different fields addressing the same kind of questions, forming a closely-knit network with strong nodes of high scientific expertise, committed to achieving common goals
- Active exchange of ideas, learning from each other
- Evaluations essential in quality control, development and maintaining dynamics



- High level of education for the whole population
- Full and efficient use of all human potential with consideration for gender balance
- Good career prospects, feasible salaries, employment of family members, children's day care and education, etc.
- Generation of new top research can be accelerated by recruiting top foreign experts; but global competition for the best is very hard





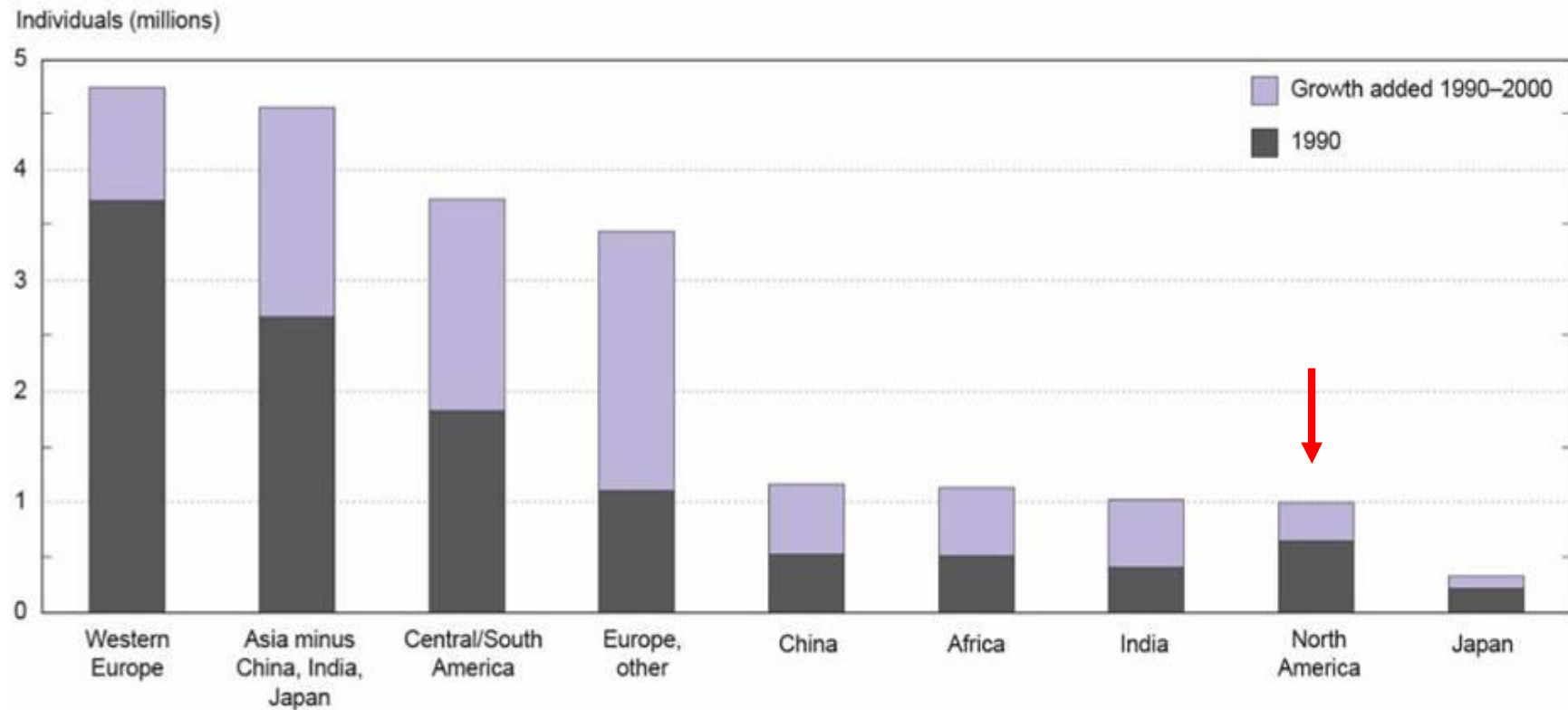
Source: She Figures 2006

- Graduate schools form integral parts of a creative research environment
- The best teachers at both graduate and post-graduate levels
- Inspiring, motivating, versatile yet supervisory:
  - promote national and international collaboration and networking
  - promote global mind-set
  - promote national and international mobility
  - promote participation in societal debate
  - promote independence
- Creation of unconventional new training strategies; interdisciplinary approach in addition to deep disciplinary competence



- Outstanding researchers are often characterised by mobility, nationally and internationally, also between sectors

## Individuals with higher education living abroad, by country/region of origin: 1990 and 2000



Source: National Science Board (US), Science and Engineering Indicators 2006

- The premises and infrastructure (incl. services) are key strategic resources (also in social sciences and humanities); very unwise to save here
- Frequent personal contacts between people working in various organisations (universities, research institutes, enterprises) and the users create fruitful interaction
- Shared premises or science parks often economically feasible, may generate new ideas and applications and enhance mobility between different organisations



- Also other functions than research (monitoring, inventories, surveys, expert tasks, statutory duties, giving services)
- Strength: cooperation with the users
- Active networking with universities as well as with industry and other users
- The cooperation potential of research institutes should be used more efficiently in the research system
- Top researchers should be actively identified and supported
- International evaluations help in identifying ways forward, in combining scientific excellence and societal relevance



- Should cooperate with centres of excellence both in conducting research and using results
  - networking with the centre
  - functioning as part of the centre (on a fixed-term basis)
- Science parks offer good frameworks for industry-academia cooperation

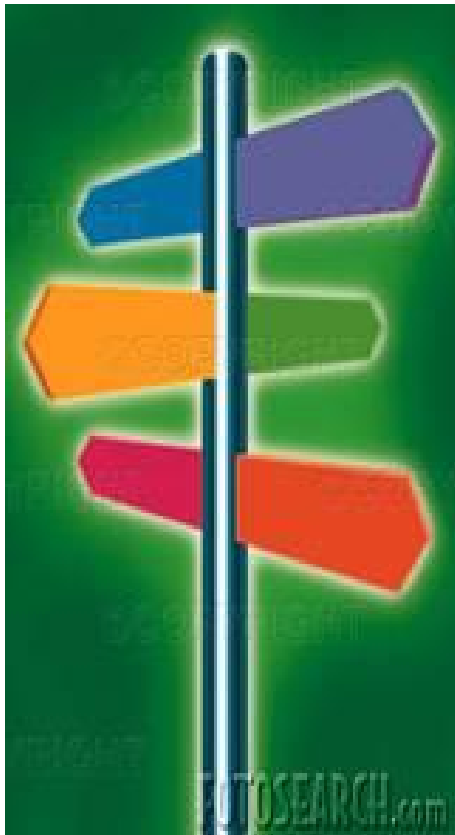


- Objectives of centre of excellence strategies: to enable the emergence of creative research and training environments of the highest international standard
- Professional management needed (both scientific and administrative)
- Outcome: cutting edge research



- Excellent research environments attract the best researchers and most ambitious young researchers from all over the world
  - the research environment becomes even better and more visible, etc.
- Spin-offs: young top researchers trained will form new creative research environments and centres of excellence
- Good scientific practices are spread throughout universities and research institutes





- If the EU is to compete at world level, we need to proactively support scientific excellence with clear societal relevance
- The EU's Joint Research Centre is/will become a 'centre of excellence/competence and influence'



European Commission  
President Barroso



Commissioner Potočník  
Science and Research  
over two DGs

(26 other Commissioners)

Joint Research  
Centre (JRC)

Research DG  
(RTD)

Customer DGs:  
Agriculture, Environment,  
Enterprise, Safety  
& Consumer Protection, etc

## Citation intensity versus wealth intensity

All smaller northern countries rate highly in scientific intensity

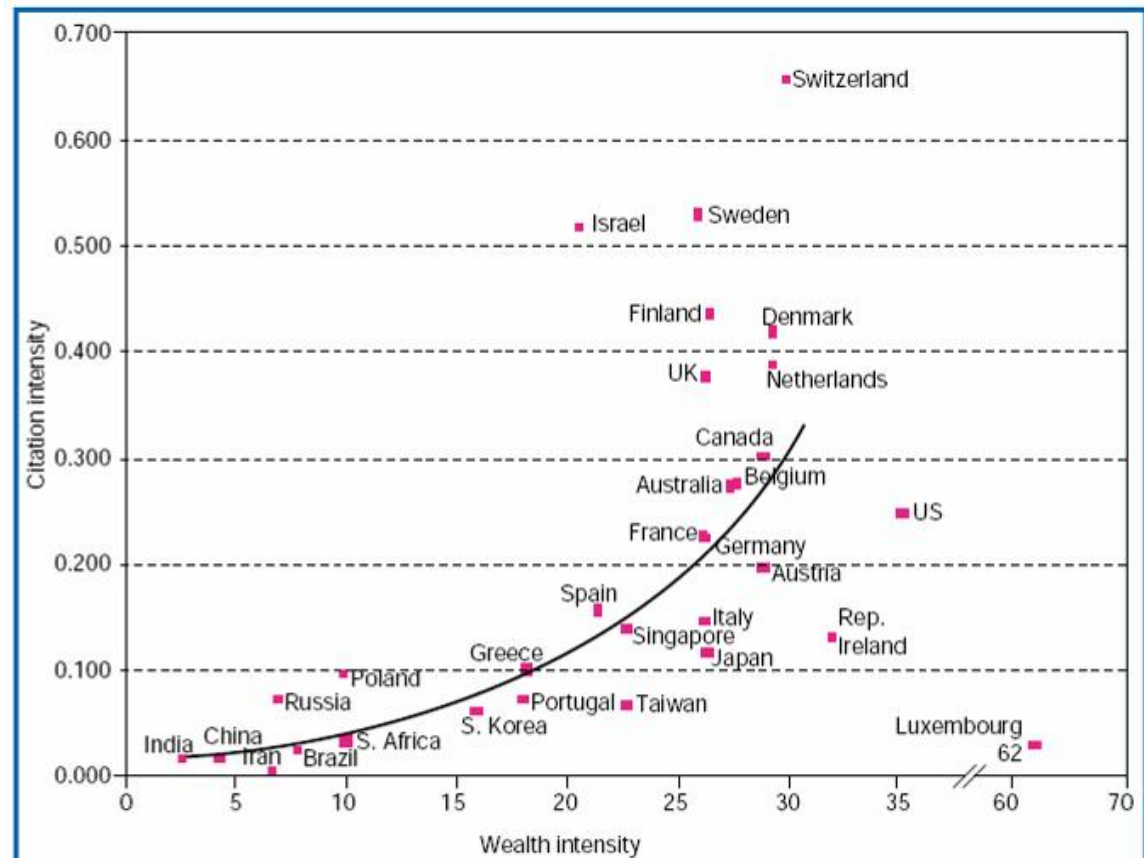
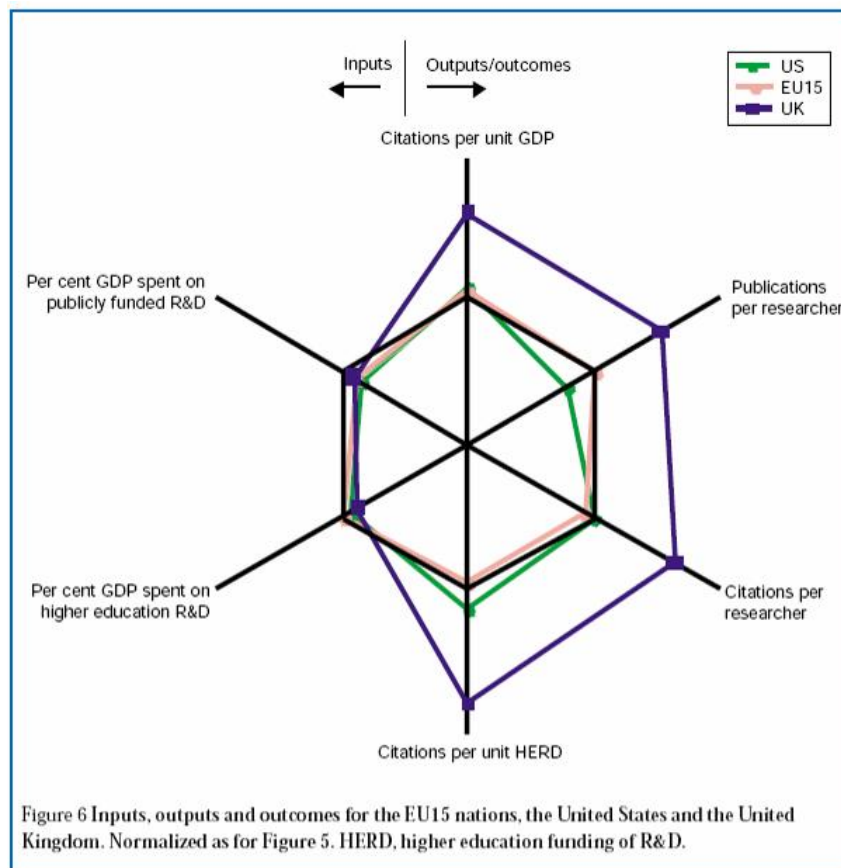


Figure 2 Comparing economic and scientific wealth. National science citation intensity, measured as the ratio of the citations to all papers to the national GDP, shown as a function of the national wealth intensity, or GDP per person, for the 31 nations in the comparator group. GDP and wealth intensity are given in thousands of US dollars at 1995 purchasing-power parity. Sources: Thomson ISI, OECD and the World Bank.

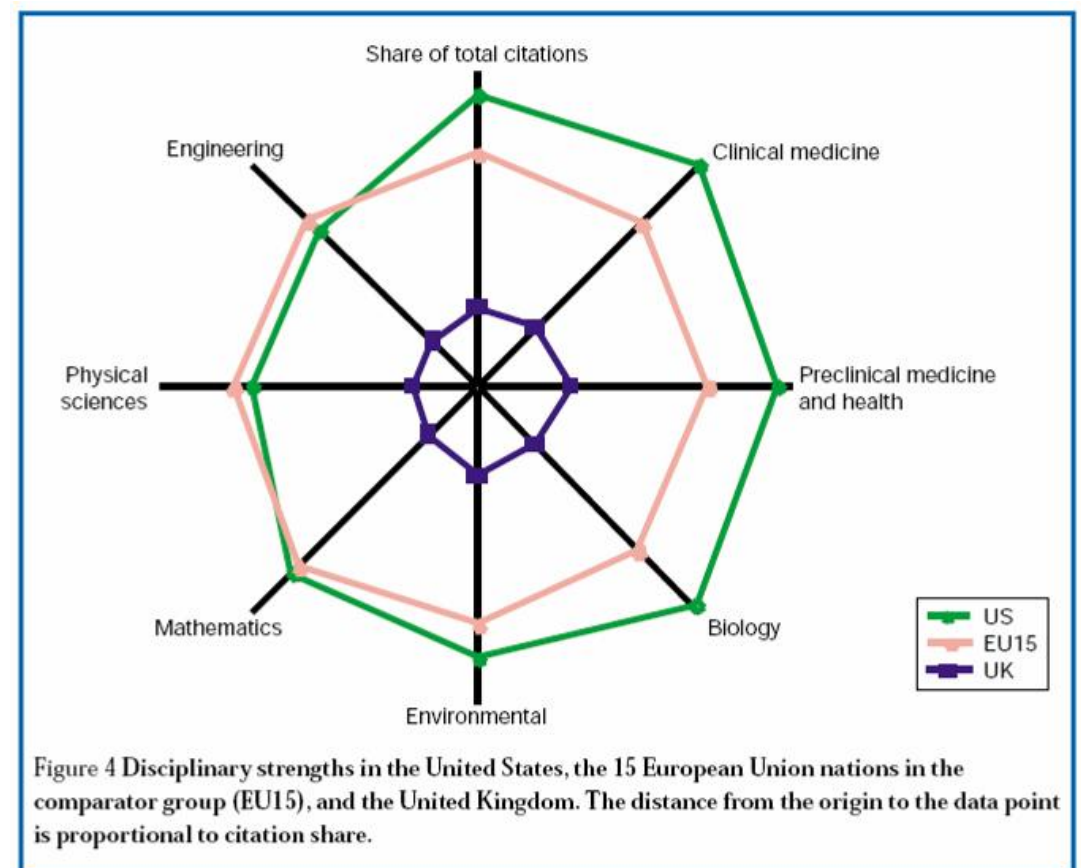
## Inputs, outputs and outcomes

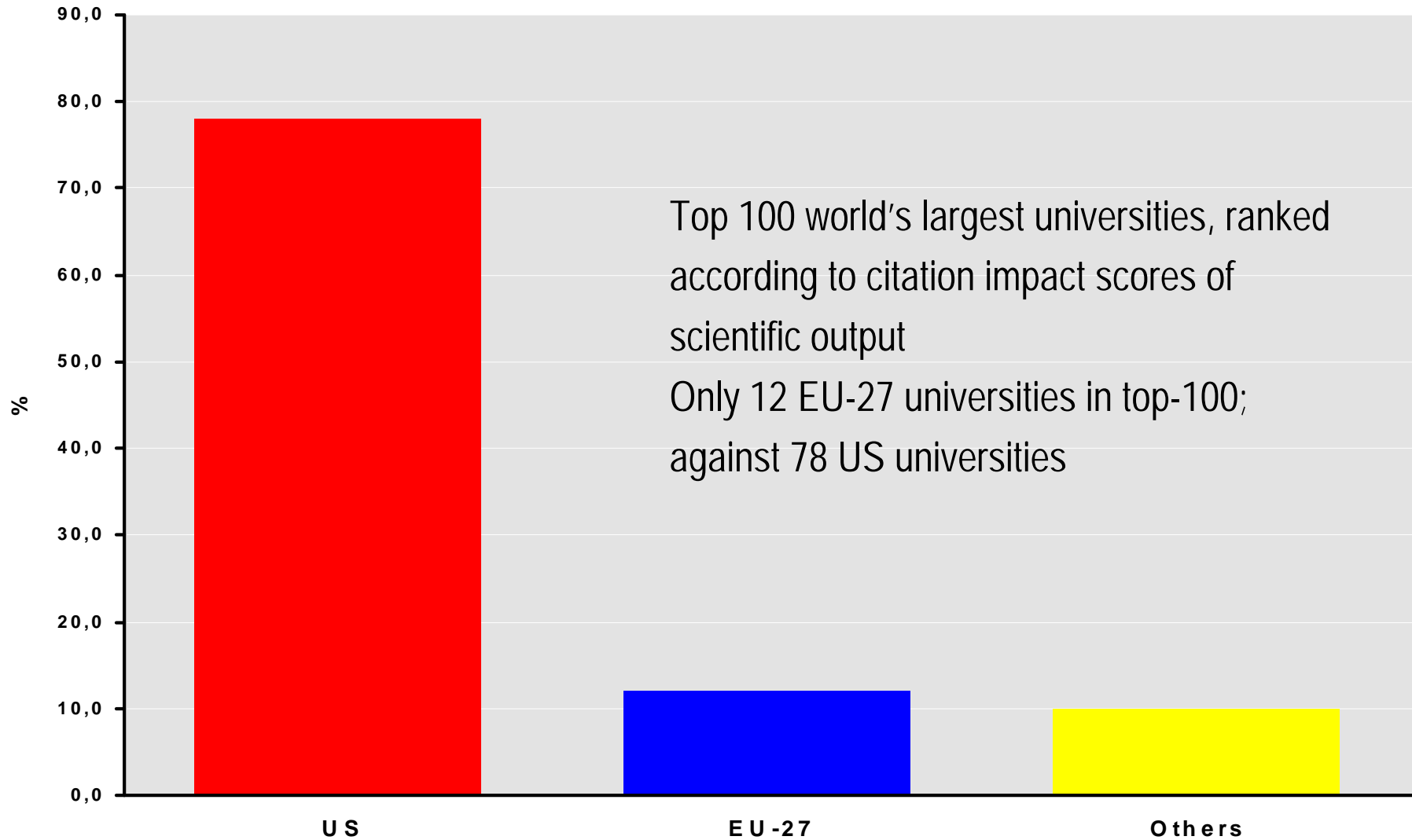
The citations per unit of publicly funded R&D are virtually identical



## Disciplinary Strengths

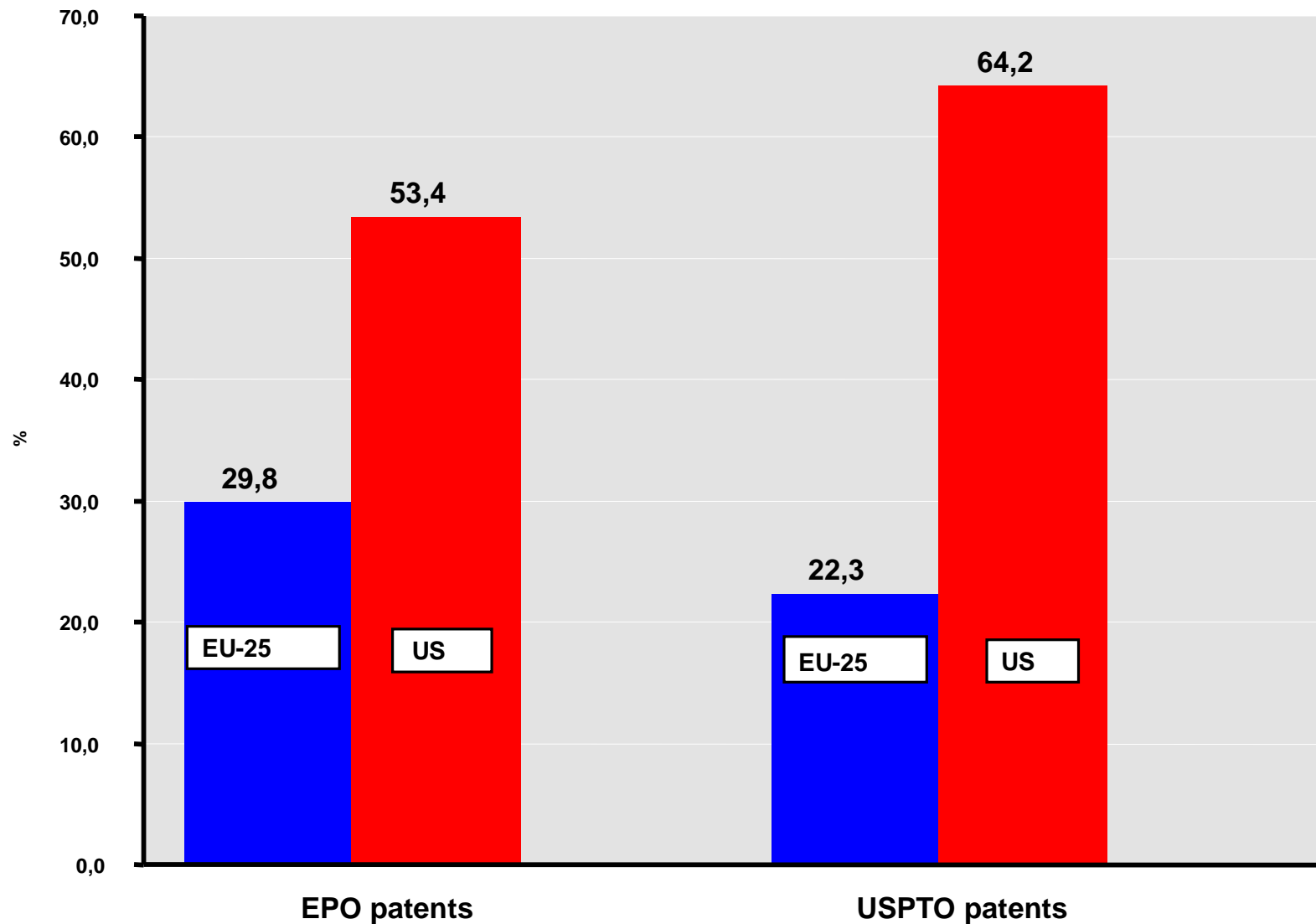
The EU matches the US in the physical sciences, engineering and maths, but it lags behind in the life sciences





Share of EU  
and US  
Scientific  
Publications  
cited in biotech  
patents

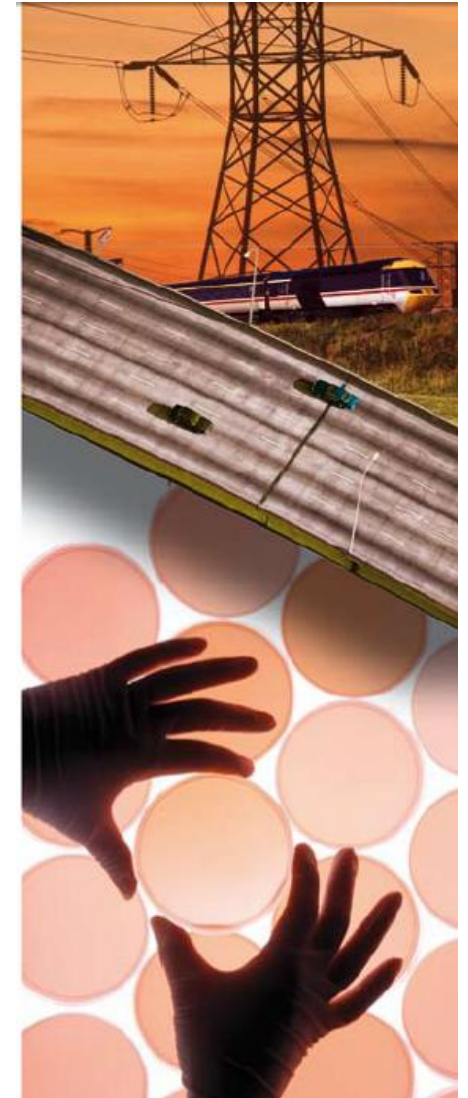
Data in other  
Technological  
fields show  
similar patterns



- The central issue for European research policy: how can Europe maintain and develop the leading edge in research which is essential to its sustained growth and competitiveness?
- To address this, the European Union developed a "broad-based innovation strategy" (September 2006) which proposes a 10 point programme for action
- Research is at the core of this strategy



- Lays out a vision and proposes possible steps: we will gain from greater European competition, cooperation and concentration
- We can pool our forces by specialising more and by allowing clusters of global excellence emerge – we can get there through a process of joint programming and evaluation, by sharing knowledge and promoting the mobility of researchers attracted by research institutions that compete and cooperate at a European level and enjoy access to world class research infrastructures
- We need a European research model that speaks with one voice, is open to the world and can shoulder the responsibility of global leadership

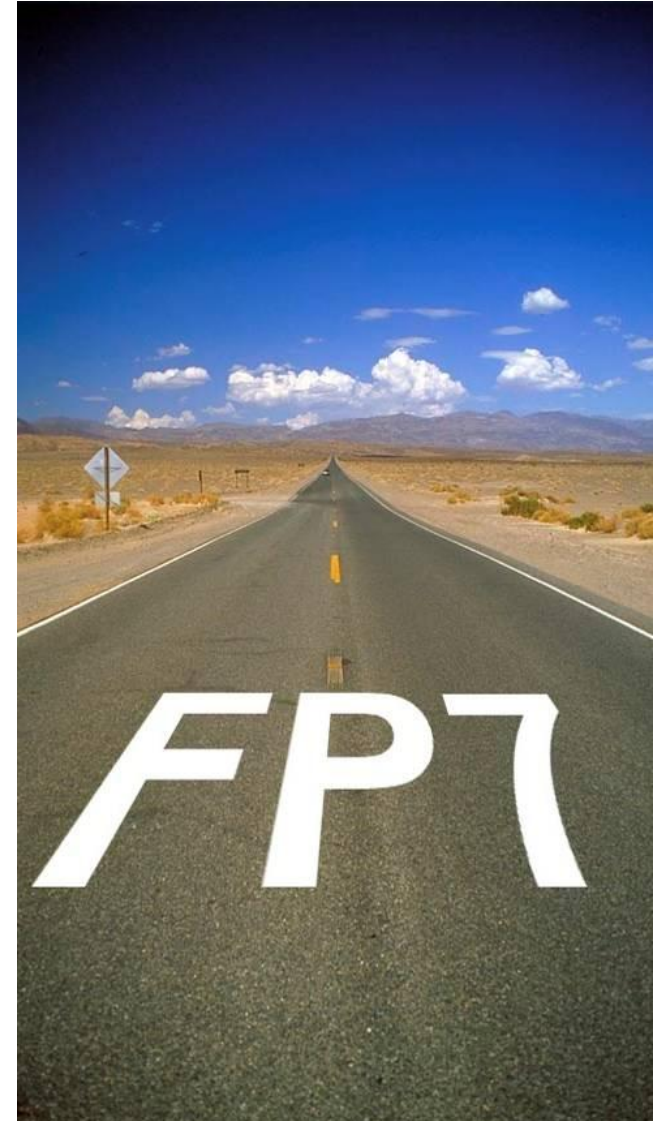


## Central challenges:

1. To break down pointless barriers to research. Why are researchers prevented from being completely mobile in all EU countries and sectors due to questionable administrative requirements?
2. Foster a greater understanding that national interests coincide with European interests. We need to embrace an attitude which sees European interests come before national interests and to take responsible global leadership



- European Research Council: independent body to support investigator-driven frontier research by the best teams in Europe
- European networks of excellence
- Joint Technology Initiatives: major public-private partnerships in fields of high growth potential, such as ICT and energy
- Marie Curie instruments
- European Institute of Technology: reinforcement of Europe's capacity to transform education and research results into business opportunities



"The mission of the JRC is to provide **customer-driven** scientific and technical **support** for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the **policy-making process**, it serves the **common interest** of the Member States, while being **independent of special interests, whether private or national.**"



- Research having a direct impact on the life of the citizen
- Provision of quality expertise and support to other Commission services, EU Institutions, Member States and in-country research stakeholders (working with over 1,000 public & private organisations, institutions and expert groups in more than 250 major networks)
- Interdisciplinary research: food safety, chemical products and health, environment and sustainability, security and antifraud, nuclear safety and security, technology foresight, reference materials and measurements
- Flexibility in responding to emerging and changing needs
- Strength through tradition - over 50 years JRC collaboration with customers and users



7 Institutes in 5 Member States  $\cong$  2650 staff (+ 250 competitive)  
 $\cong$  300 M€/y budget (+ 40 M€/y competitive)  
 124 scientific projects (called actions)



**IE** - Petten The Netherlands  
 - *Institute for Energy*



**IRMM** - Geel Belgium  
 - *Institute for Reference Materials and Measurements*



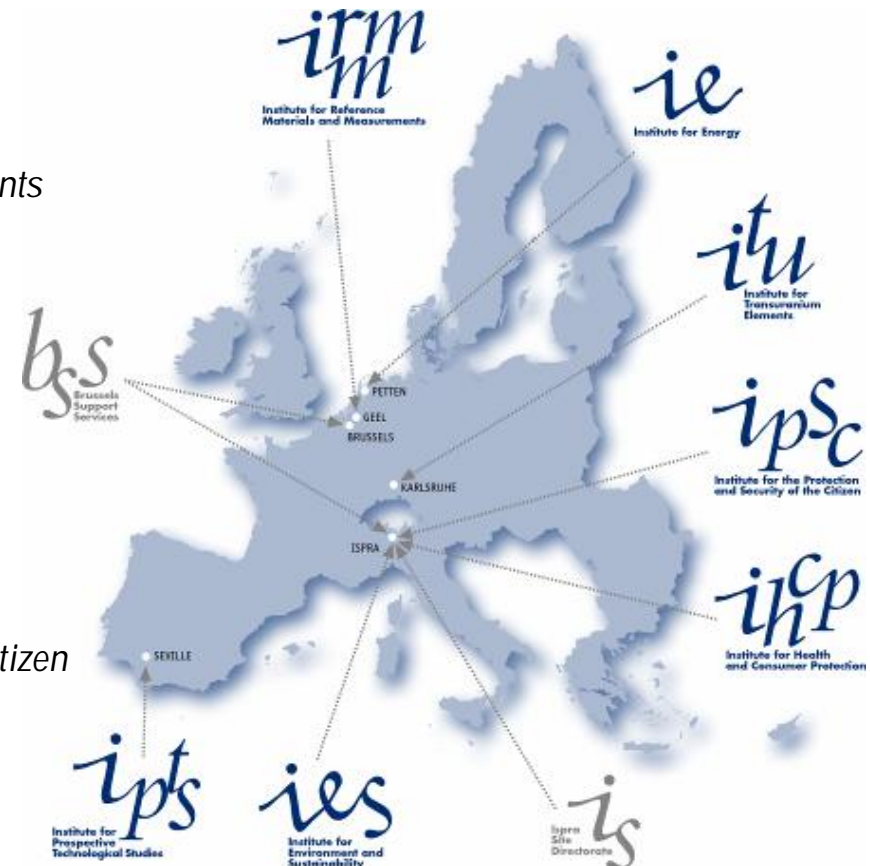
**ITU** - Karlsruhe Germany  
 - *Institute for Transuranium Elements*



**IPSC - IHCP - IES** - Ispra Italy  
 - *Institute for Environment and Sustainability*  
 - *Institute for Health and Consumer Protection*  
 - *Institute for the Protection and Security of the Citizen*



**IPTS** - Seville Spain  
 - *Institute for Prospective Technological Studies*



Petten: new test facilities for hydrogen storage and fuel cells. These provide evaluation of hydrogen storage technologies and fuel cell performance in terms of efficiency, safety, environmental friendliness and reliability, to facilitate wider market introduction



Geel: a 150 million electron volt linear accelerator for neutron data measurements. Among all the pulsed white spectrum neutron sources available in the world, this linear electron accelerator facility has the best time resolution.



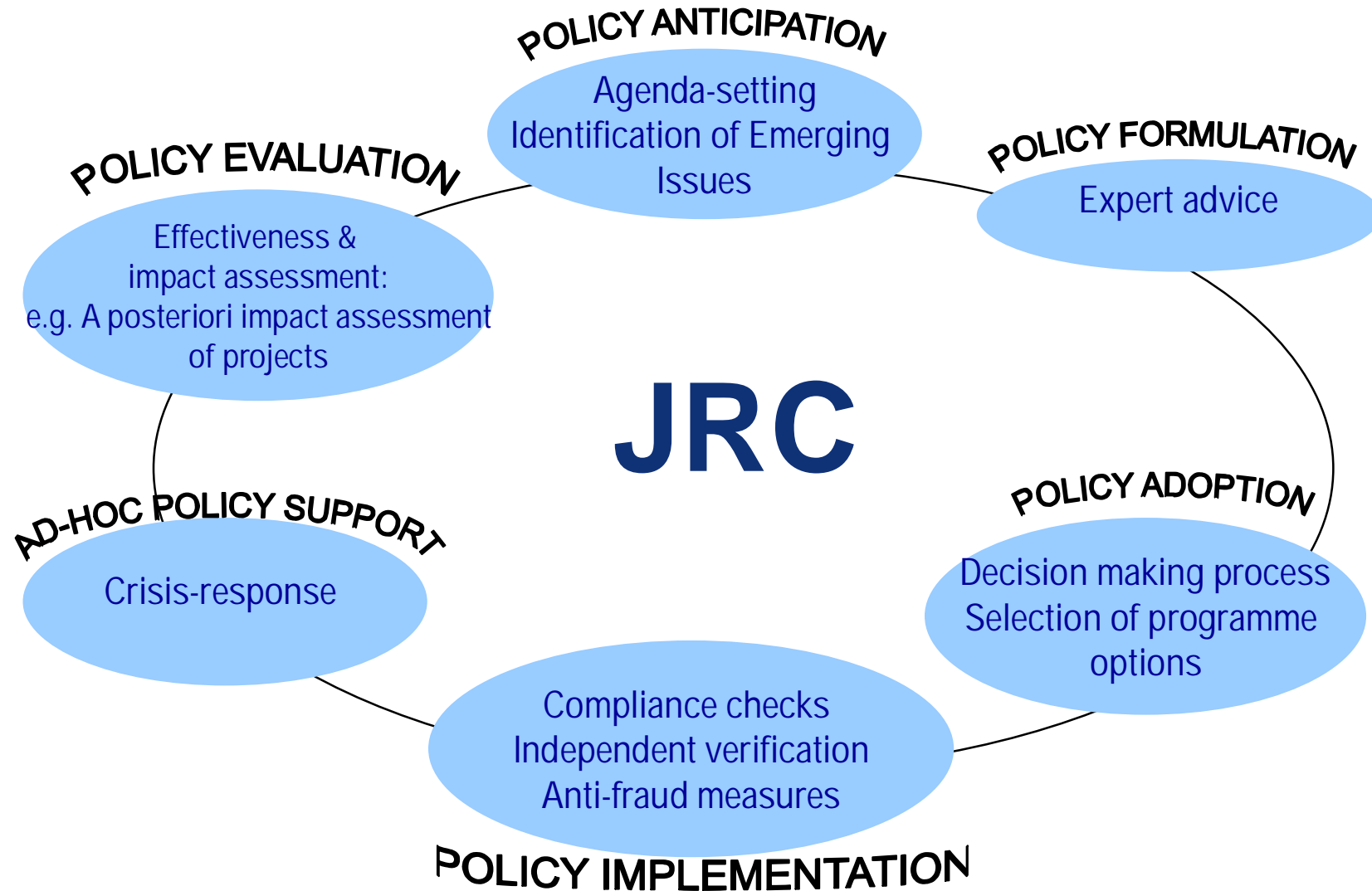
Karlsruhe: an actinide laboratory for performing basic research into the fundamental chemical and physical properties of actinides. Research results serve to improve nuclear safety and security.



Ispra: the vehicle emissions laboratory which, with the most advanced facilities and instrumentation, allows the physical/chemical and toxicological characterisation of the emissions from all types of transport fleet.



JRC sites have the potential to become science parks!



The JRC is participating in the CarboEurope project to combat climate change. The aim of the project is to understand and quantify the terrestrial carbon balance of Europe and at local, regional and continental scale.

The Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) project gives an indicator of the state of vegetation. The JRC developed mathematical algorithms to enable the documentation of spatial variability and temporal evolution of vegetation cover over large areas and over long time periods.

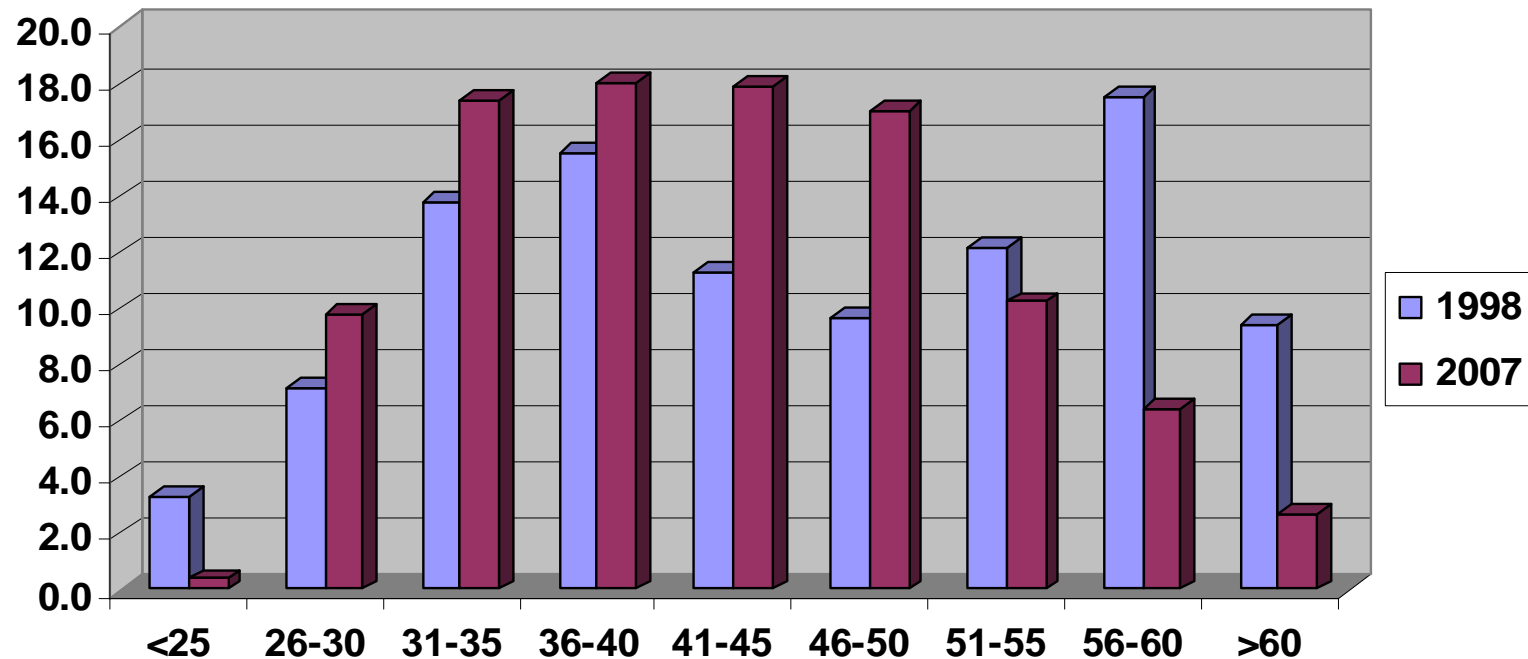
The JRC is managing 6 Community Reference Laboratories in areas concerning the safety and quality of feed and food:

(1) Feed additives, (2) GMOs, (3) Food contact materials, (4) heavy metals in feed and food, (5) mycotoxins and (6) polycyclic aromatic hydrocarbons



- Over 1000 visiting staff (>35%) including senior researchers, post docs, doctoral students, visiting researchers, national experts and trainees
- 47 different nationalities

**Age distribution of statutory staff in percent 1998-2007**



The JRC undergoes regular evaluation exercises:

- Ex-post evaluation of all the framework programmes
- Periodic Action Reviews (PARs) – yearly review of all JRC projects (actions):
  - impact on EU policy making
  - Scientific output
- Customer satisfaction surveys – in the 2005 survey, over 85% satisfaction with the JRC's scientific quality and service provided.
- Staff opinion surveys



- Long-term work and support essential
- Development of creative research environments requires forward looking attitudes and wise decisions in all parts of the research system
- Olli Lounasmaa (1996): all financiers and people responsible for allocating resources (rectors, deans, research directors) should systematically aim at identifying the researchers with potential to form centres of excellence. These researchers must be provided with generous resources for a few years. If the results are good, funding should be continued. Researchers must be aware of this and understand the responsibilities that this entails



Many thanks for your  
attention!

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