OCDE ORGANISATION DE COOPÉRATION ET DE DÉVELOPPEMENT ÉCONOMIQUES

Assessing the socio-economic impacts of public R&D

A review on the state of the art, and current work at the OECD

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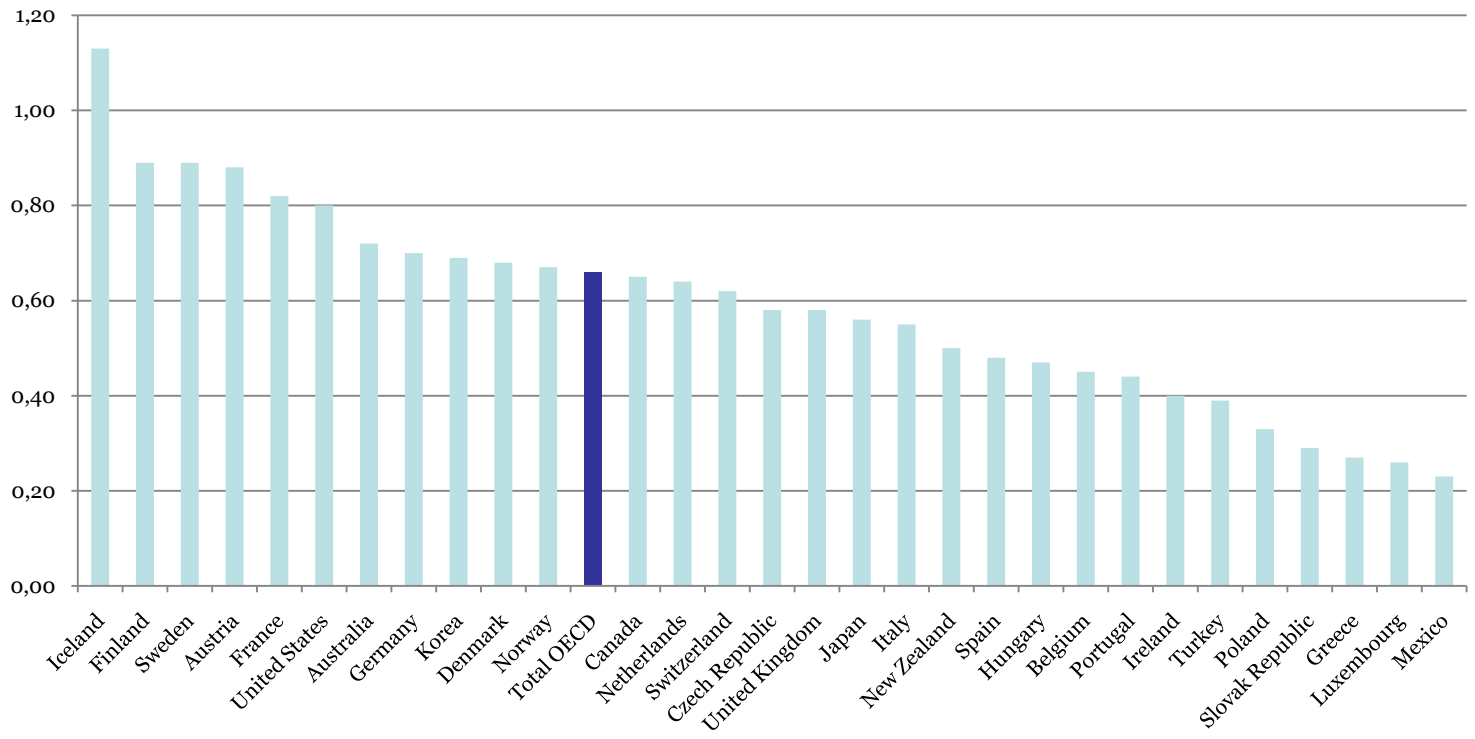
Public R&D and innovation

- Public R&D plays a crucial role in the technological development and economic competitiveness of a country (Rosenberg and Birdzell, 1990, Fagerberg 1994, Tijseen 2002)
- Benefits of public R&D accruing to society (Salter and Martin, 2001):
  - Skill development
  - Generation of new knowledge, new scientific instruments, methodologies
  - Creation of new products, companies, improved processes, etc.

Public R&D in OECD countries (1/3)

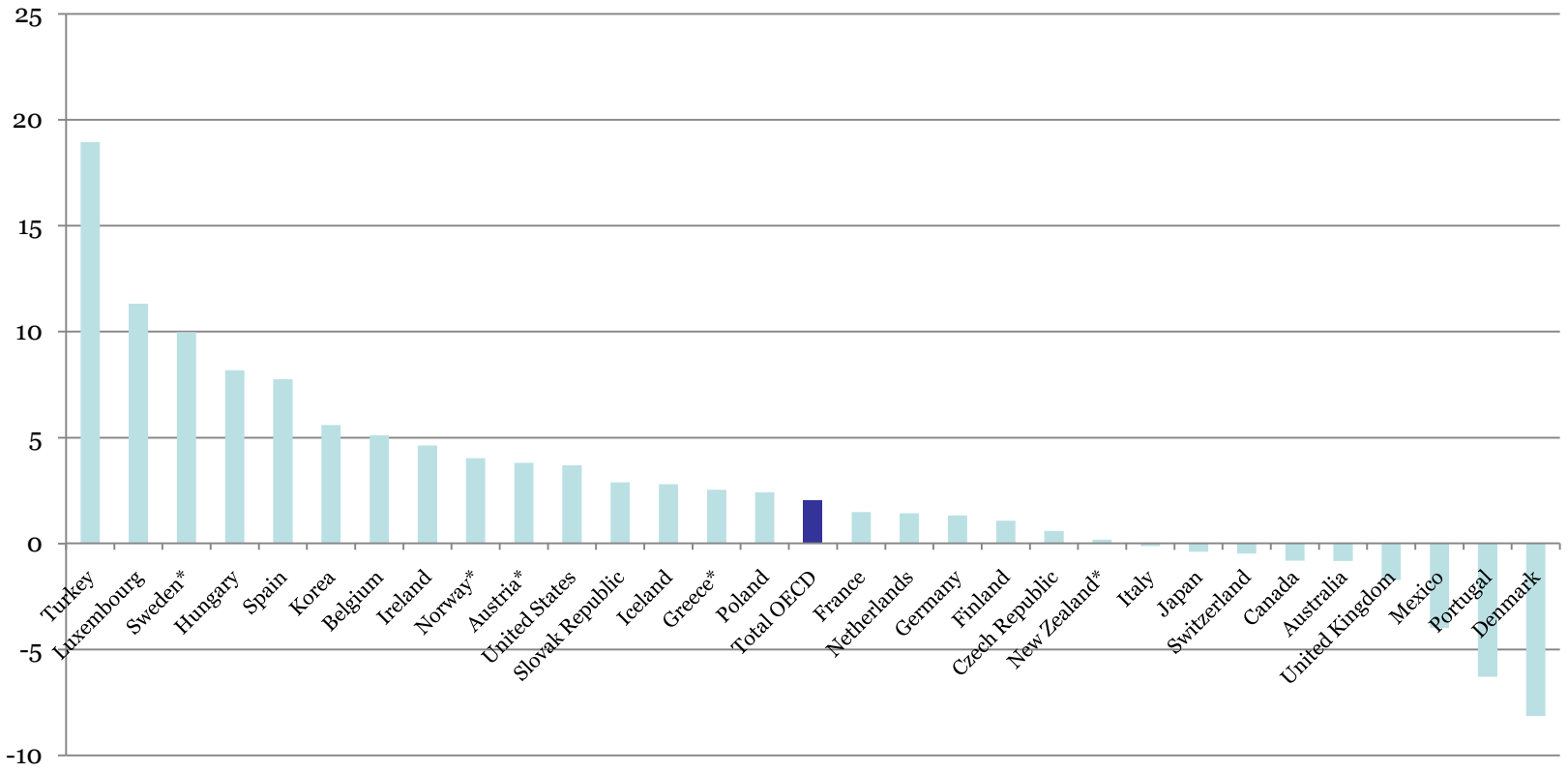
Government-financed GERD as a percentage of GDP(2005)



Source: OECD, MSTI (2008)

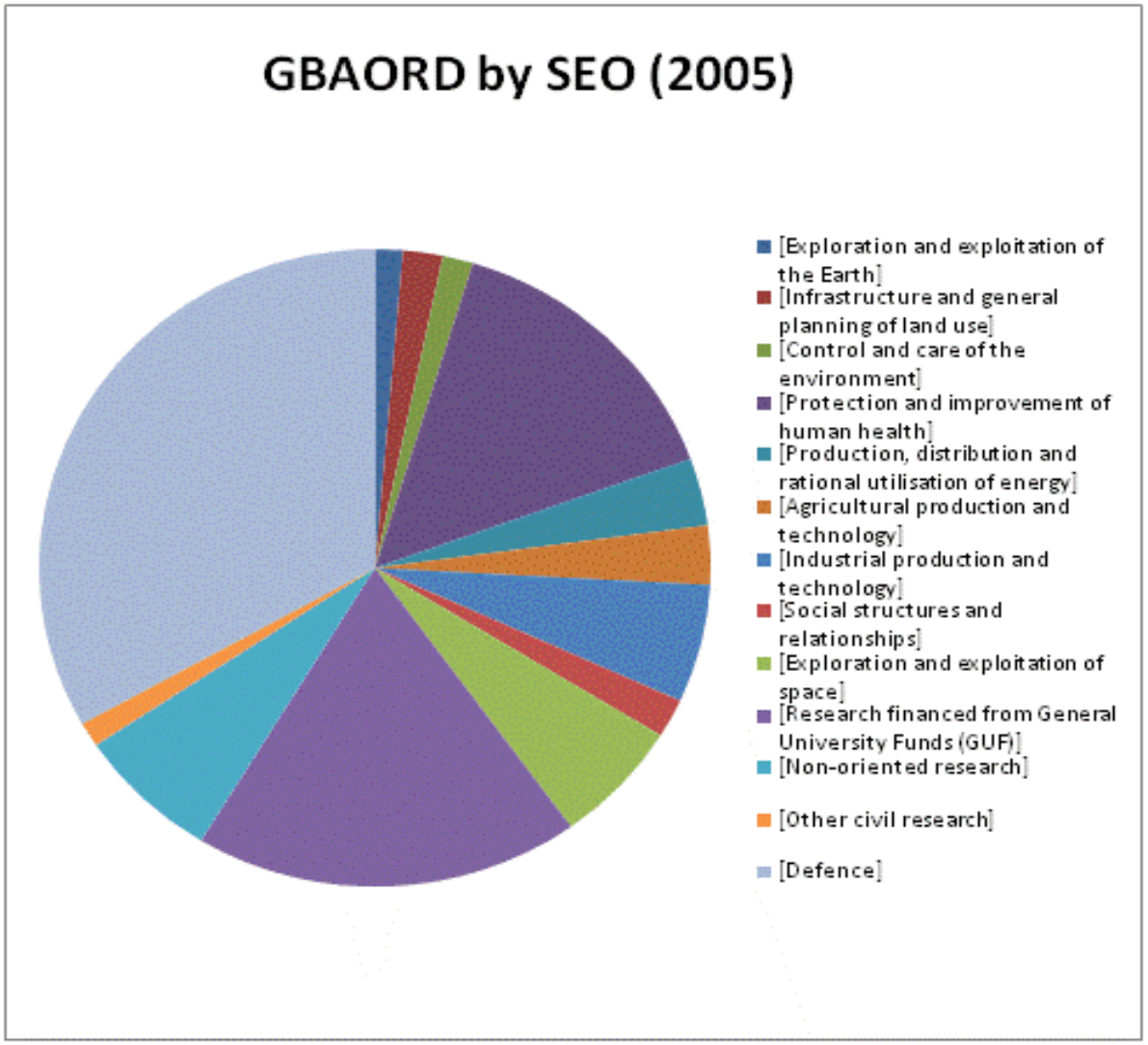
Public R&D in OECD countries (2/3)

Average annual growth rate of GOVERD (2000-2005)



Source: OECD, MSTI (2008)

Public R&D in OECD countries (3/3)



Importance of assessing the impacts of public R&D

- Determine its contribution to public objectives, such as economic growth, health outcomes, energy security
- Justify investments vis-à-vis other alternatives (e.g. education, health, etc)
- Raise awareness in the public and create a better informed society
- Enhance public accountability

Defining “public R&D” impacts

Many definitions of “impacts”, depending on:

- The **nature** of the impact: economic, scientific, technological, cultural, societal environmental, etc.
- The **scope** of the impact: systemic, organisational, firm-based
- The **timing** of the impact: estimated, contemporary, ex-post

Challenges assessing public R&D impacts

- **Causality problem**
  - What is the relationship between research inputs, outputs, outcomes and impacts? No direct or unidirectional relationship
- **Attribution problem**
  - What portion of the benefits should be attributed to initial research and not to other inputs?
- **Internationality problem**
  - Role of spillovers
- **Evaluation time scale problem**
  - At which time should we measure the impacts?
- **Definition of appropriate indicators**

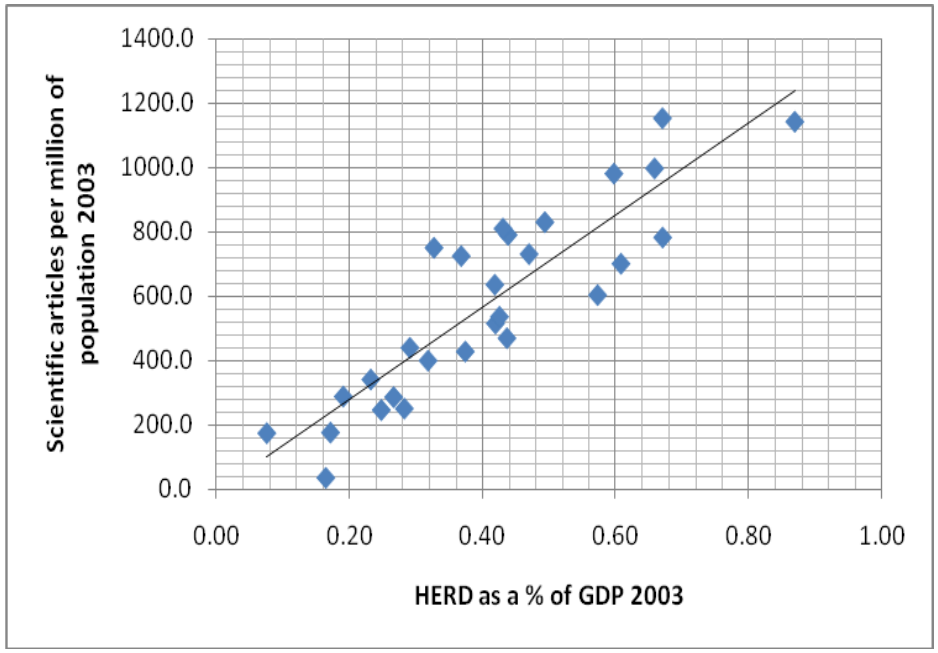
Traditional approaches to measuring "impacts" (1/2)

Traditionally, most work focused on input indicators. Recently, more indicators on research outputs have become available.

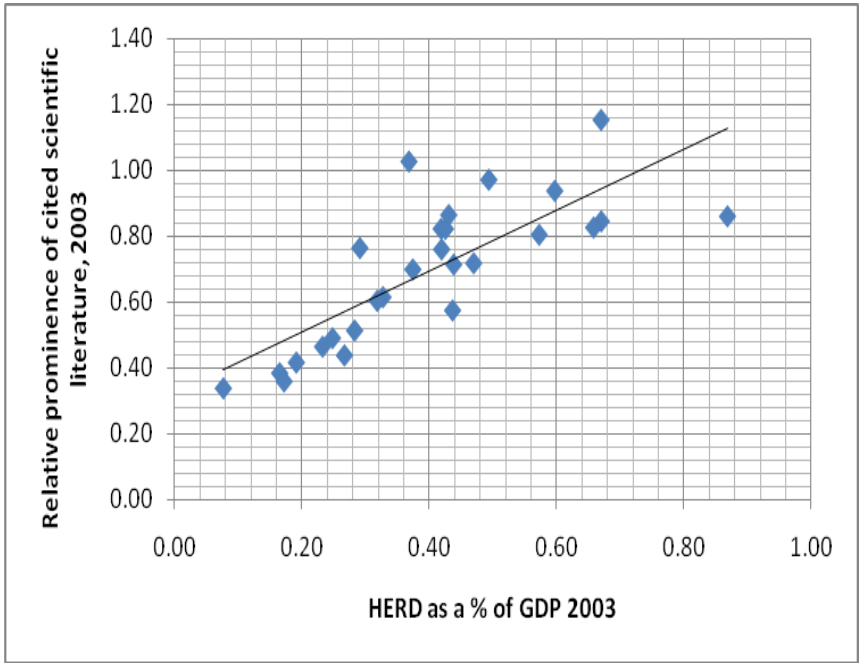
	R&D Inputs					R&D Outputs		
	Total Public R&D (GOVERD + HERD) 2005*	GOVERD 2005* (% of GDP)	HERD 2005* (% GDP)	Basic Research 2005* (%GDP)	Researchers 2004* (per thousand of labour force)	Scientific articles per million population, 2003	Relative prominence of scientific literature, 2003	Share of PCT patents owned by Gov + HE (2002/04)
Iceland	1.28	0.66	0.62	0.53	13	701.8		
Sweden	1.00	0.24	0.76		10.8	1142.8	0.86	0.0
Finland	0.99	0.33	0.66		15.7	997.9	0.83	0.4
Canada	0.90	0.18	0.72		7.3	783.2	0.85	10.3
France	0.79	0.37	0.42	0.52	7.3	516.2	0.76	10.8
Austria	0.77	0.12	0.65	0.39	6.6	604.4	0.80	1.1
Australia	0.76	0.28	0.48	0.42	7.9	791.2	0.71	10.3
Denmark	0.76	0.18	0.58	0.46	9.1	981.6	0.94	3.2
Germany	0.75	0.34	0.41		6.8	536.9	0.82	1.7
Netherlands	0.74	0.24	0.50		4.5	830.6	0.97	1.4
Japan	0.73	0.28	0.45	0.4	10.2	470.3	0.58	4.4
Norway	0.71	0.24	0.47	0.28	8.9	731.4	0.72	0.5
Switzerland	0.70	0.03	0.67	0.84	5.8	1153.5	1.15	2.2
United States	0.68	0.31	0.37	0.48	9.5	725.6	1.03	10.0

Traditional approaches to measuring “impacts” (2/2)

Relationship between R&D in Higher education and Scientific articles



Relationship between R&D in higher education and the relative prominence of cited scientific literature



New Practices assessing Public R&D impacts (1/4)

- Econometric Studies:
  - Microeconometric and macroeconometric analyses of spillovers and social rate of return. Positive effects of (public) R&D on productivity gains
  - Analyse systemic effects in the economy
  - They say little about the innovation process or non-economic impacts of public R&D
- Capitalisation of R&D:
  - (Part of) R&D investment can be capitalised, if an investment to generate future assets
  - "R&D capital" can then be introduced in the production function and estimate its impacts
  - The nature of public R&D generates questions about to what extend it can be capitalised

New Practices assessing Public R&D impacts (2/4)

- General Equilibrium Models type:
  - They can represent in a complex model the relationships established in the economy and estimate (ex-ante) the effect of a change in the model (e.g. increased public R&D) on different parts of the economy
  - The definition of the equation systems and their interrelations rely on a large number of assumptions
- GBAORD:
  - They allow to identify the relationships between input and output indicators classified by specific socio-economic objectives
  - They don't say much about the process on innovation or achievement of goals

New Practices assessing Public R&D impacts (3/4)

- Use of indicators/benchmarking:
  - Easy to compare the evolution and progress on a number of key variables.
  - They fail to explain the process of innovation
- Micro-data analyses:
  - It uses information on enterprises participating in innovation surveys across different countries and it shows the positive role of public R&D (through collaborations between firms and PROs and public funding) on innovation in a series of countries
  - Positive effects are calculated at the micro level and they need to be aggregated in a more meaningful aggregate impacts

New Practices assessing Public R&D impacts (4/4)

- Survey based studies:
  - Through a large survey, identification of individual benefits (added value) on the stakeholders participating in the space programmes
  - This methodology can only be applied to industry focused research and cannot take account of longer term effects
- Case studies:
  - They provide very detailed information about the sources and mechanisms of the impacts
  - The impact analysis tend to be very context specific and difficult to scale up to other experiences

Current work at the OECD (Objective)

- Overall objective

  To improve our understanding of the relationship between public R&D investment and its socio-economic impacts

- Specific objectives:
  - To create a forum of debate between science policy researchers, economists and policy makers
  - To identify national practices dealing with assessing impacts of public R&D investments
  - To highlight particularly promising approaches towards measuring the impacts of public R&D
  - To establish a basis for improved cross-country comparative approaches and methodologies (including the establishment of new data sources and indicators)

Current work at the OECD (Activities)

1. **Stocktaking of national practices in the field of public R&D impact assessment, organised by objective. The conclusions:**
   - Understanding and measuring the impacts of public R&D is crucial
   - Several challenges avoid a straightforward measurement
   - **The choice of methodology is not universal but context specific**
   - New analytical techniques are being developed
   - All the analytical techniques that intend to capture the full range of impacts of public R&D are still evolving
2. **Expert workshop to take stock and identify new tasks**

Further work can be continued

- Although progress has been made, still:
  - Methodological frameworks can be improved
  - A common framework to develop and use methodologies has not been agreed to and international collaboration is needed
  - International progress in improving methods and using them across countries could result in enhanced comparability of impacts
  - Impacts that can be observed at the micro level need to be aggregated to more meaningful aggregate impacts