

Developing Methodologies for the Impact Analysis of Research Infrastructures on Innovation

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Infrastructures for a Competitive Knowledge
Economy”

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Structure of the presentation

The growing interest in measurement/monitoring of impact of R&D activities

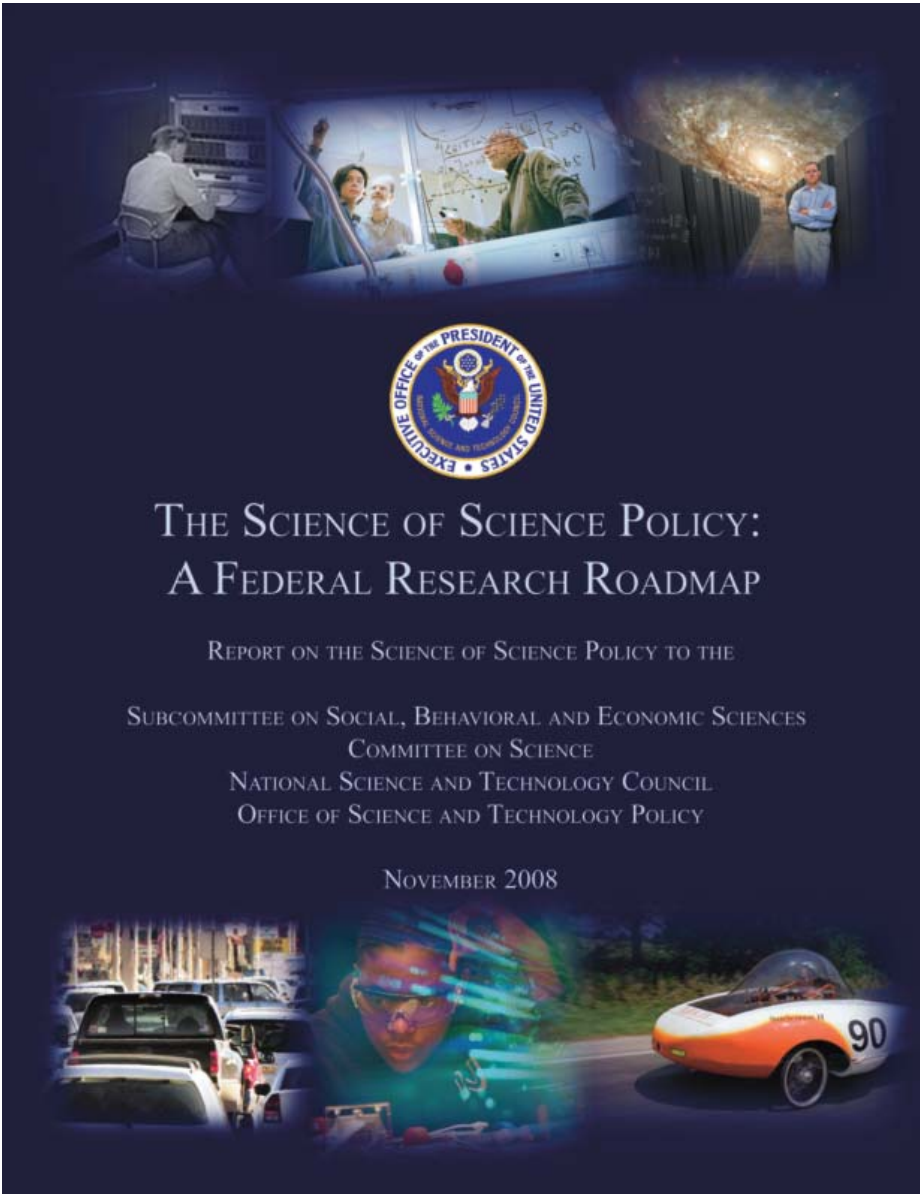
What are the impacts of R&D? How do they relate to Research Infrastructures (RIs)?

How can we measure these impacts?

What needs to be done to take this work forward?

What lies behind the growing interest in measuring the impact of R&D activities?

- Competition for scarce resources
- Interest in promoting innovation – regarded as a product of R&D
- The public engagement agenda – more accountability required given the scale of public expenditure on R&D
- The growth of large scale research infrastructures and the variety of funding mechanisms now available



USA – the National
Science Foundation

Science of Science
and Innovation Policy
Programme (SciSIP)

http://www.scienceofsciencepolicy.net/uploads/SoSP_Report.pdf

The importance of this challenge derives from the magnitude and centrality of the contribution that science and technology make to the U.S. economy. In 2007, the U.S. Federal government R&D budget totalled \$139 billion, affirming the importance of Federal investments in science and technology. It is imperative to advance the scientific basis of science policy so that limited Federal resources are invested wisely. **Scientific models must be developed, along with methods of collecting real-time quantitative and qualitative data so that future policy decisions are based on sound science and informed by meaningful metrics. Retrospective analysis is also needed, to analyze the impact of Federal investments on scientific discovery and innovation, the economy, and society. In this way, past investments may help inform future decisions, refine the accuracy of models, and maintain the nation's dominance in the scientific arena.**

The Science of Science Policy: a Federal Research Roadmap (p3)

UK National Endowment for the Arts, Science and Technology (NESTA)

Innovation growth accounting: Measuring investment in innovation and its contribution to productivity growth, linking it to the national accounts.

Measuring firm-level innovation performance: Develop and produce accurate indicators of innovation activity for 6 areas of the UK economy which capture the innovation that matters in each sector.

Wider framework conditions for innovation: Map, measure, examine and judge the health of the 'wider conditions' found to be the most significant drivers of UK innovative capacity.

Measuring user-led innovation: Develop and implement a methodology to measure the amount of user-led innovation being performed in the UK by different types of users.

<http://www.innovationindex.org.uk/>

Measuring innovation

Oslo Manual definition:

A technological product innovation is the implementation/ commercialisation of a product with improved performance characteristics such as to deliver *objectively new or improved* services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these



Measuring innovation

Community Innovation Survey definition:

A product innovation is *the market introduction* of a new good or service or a significantly improved good or service with respect to its capabilities, such as improved software, user friendliness, components or sub-systems. The innovation (new or improved) must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises

The Fourth Community Innovation Survey
(CIS IV)

THE HARMONISED SURVEY QUESTIONNAIRE

The Fourth Community Innovation Survey (Final Version: October 20 2004)

This survey collects information about product and process innovation as well as organisational and marketing innovation during the three-year period 2002 to 2004 inclusive. Most questions cover new or significantly improved goods or services or the implementation of new or significantly improved processes, logistics or distribution methods. Organisational and marketing innovations are only covered in section 10. In order to be able to compare enterprises with and without innovation activities, we request all enterprises to respond to all questions, unless otherwise instructed.

Person we should contact if there are any queries regarding the form:

Name: _____
Job title: _____
Organisation: _____
Phone: _____
Fax: _____
E-mail: _____

Defining 'impacts' of Research and Development

- Scientific:* Contribution to scientific theory, knowledge; development of our understanding of processes
- Technological:* Development of new products, services; 'spin-offs' from R&D
- Economic:* Contribution to the economic growth; redistribution of resources at individual, local, regional national and global levels; development of human resources
- Social :* Contribution to individual, family, community well being
- Political:* Contribution to political stability; regional, national and supranational cohesion
- Environmental:* Contribution to improved environmental systems, sustainability

Who has an interest in these impacts?

Interest from	Scientific impact	Technological impact	Economic impact	Social impact	Political impact	Environmental
Scientific community	***	**	*	*	*	*
Funding Bodies	***	***	*	*	*	*
Policy makers	**	**	***	***	***	***
Business community		***	***			*
General public	**	***	***	***	***	***

For RIs, what are the indicators of these impacts?

Type of impact	Measured by:
Scientific impact	Peer review; academic papers; rate of utilisation of the resource
Technological impact	Potential for spin-off products, services; links to private sector
Economic impact	Contribution to GDP at regional and national levels; employment and incomes created at local, regional, national and supranational levels
Social impact	Contribution to family and community wellbeing; amenity value of the facility
Political impact	Contribution to political stability, cohesion
Environmental impact	Impact on air, water quality; CO ₂ footprint

Modelling impacts

Economic and econometric models

Input-output models (typically used for assessing the employment impact of an addition to gross output)

Total Factor Productivity decomposition (to determine the impact of innovation on productivity)

Vector Autoregressive Techniques (for modelling time series variables)

Spatial models ('gravity' models, geographically weighted least squares estimation techniques)

What types of measurement do we need for the study of these impacts?

Examples of the range of data needed:

Quantitative information – from existing large scale household survey, specially commissioned household and organisation based survey sources.

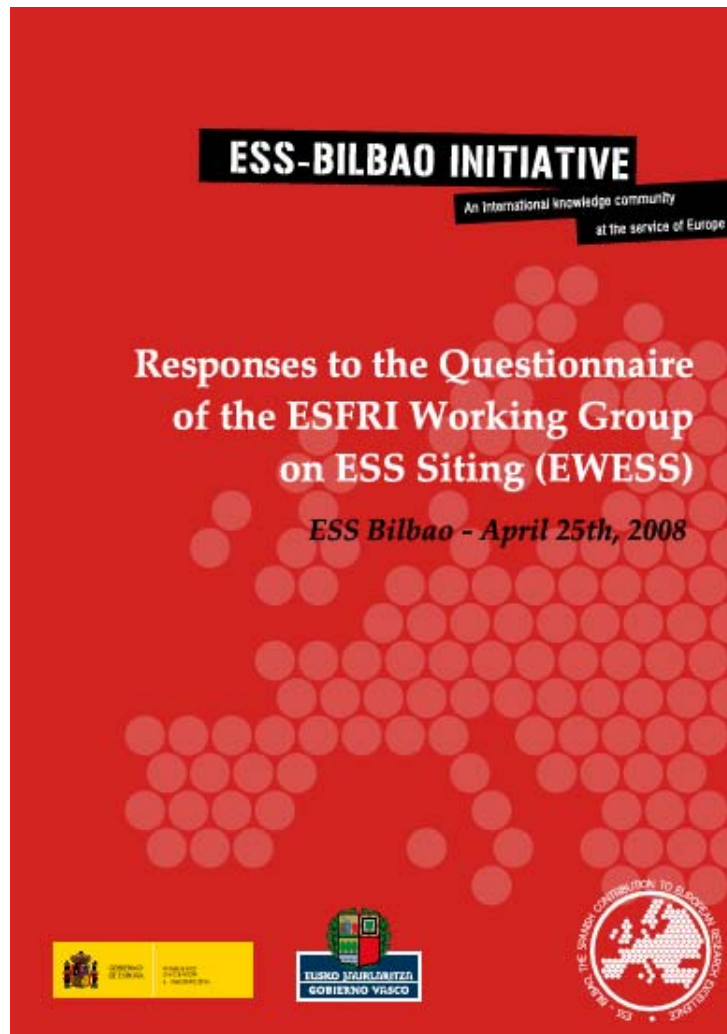
Administrative data – from tax and social security records, from organisation payroll data and sales, purchases.

Monitoring instrumentation – environmental indicators.

Qualitative information – interviews with key informants; focus groups.

Public engagement – web consultations, public meetings.

An Example – site decision for the European Spallation Neutron Source



Two methods used to estimate economic impact if the ESS had been sited in Bilbao: Input – Output Modelling and Vector Autoregressive techniques

Consideration also of the environmental impact of the potential site decision

A coordinated approach to evaluation of impact of RIs

1. Recognise the variety of types of RIs (Single site, multi-site, networks, databases, remote access facilities, etc.)
2. Bearing this variety in mind, prepare a manual on *Impact Evaluation for RIs*
3. Establish a European body with responsibility for conducting broad-based Impact Assessments to a required standard (ESFRI? A new body?)
4. Require RIs to contribute information to this body