EVALUATION OF « RETURN ON INVESTMENT »
IN
A RESEARCH FUNDING ORGANIZATION

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HFSPO

Investment in research

- 800 bio USD PPP in 2004 worldwide
- 250 bio USD from public funding
- 2 to 4 % of GDP
- 800 USD/per capita in G7 countries

The necessity to invest in research is seldom challenged:

- international benchmarking, national competitiveness, pride, independence, security
- Historical evidence of research results with considerable impact : X Ray, Laser, Quantum physics .. and also restriction enzymes, Viterbi's algorythm …

Source : OECD, Main Science and Technology Indicators, November 2005.

A long history of conceptual and statistical work to describe input and output

As early as the 30's (Schumpeter's "Business cycles")

- OECD
  - Frascati's manual (1963)
  - Science and technology indicators (1984) now known as Science, Technology and Industry Scoreboards
- US National Bureau of Economic Research (50's – 60's)
- NSF Science indicators (1972)

Methods to evaluate output are mature* and applied at different scales (nation, regions, institutes) and perspectives (international, interdisciplinary, private/public, civilian/military …)

* and more advanced than those to assess input.

Yet …

" … After 60 years of statistical work, we still measure the inputs …but very seldom the outputs and the impacts…

The challenges lies … when it comes to measuring results that sometimes remain intangible, not to mention the fact that they often manifest themselves only in the very long term"

Benoit Godin (2004, The Who, What, Why and How of S&T Measurement)

Evaluation of research organizations

Qualitative: panel review, analysis of processes, fairness and transparency, accountability…

Quantitative: overheads, publications, citations/researcher citations/$, patents, royalties …

Used as a basis for ranking and making decisions

- League tables, Australian university scorecard
- German “blue list institutes”, US GPRA, France CNRS

HFSPO evaluation as an example

- Human Frontier Science Program: frontier research in life science, interdisciplinary and intercontinental.
  - HFSPO is reviewed by independent consultants and evaluated at regular interval by HFSP Intergovernmental Conference (IGC)
  - General reviews in 1996, 2001 and 2005/2006

- Combination of methods: bibliometry, interviews, high level scientific panels to assess
  - quality of process and implementation
  - quality of science funded
  - Uniqueness and usefulness

Pros and cons of evaluation of research funding organizations

- A robust and mature method
  - Matured quantitative and qualitative approaches
  - Provide acceptable measure of creation of knowledge by researchers and quality of implementation

- With significant limitations:
  - Expensive and time consuming.
  - Subjectivity of judgment and « smart use » of indexes
  - Often parochial and on limited timescale.
  - Different methodologies prevent comparison and consolidations.
  - Ill-suited for increasingly networked research.

Policymakers need evaluation of global impact

"The assessment of the FP should be further developed systematically and should reflect the new understanding of the interactive nature of innovation … should also address the structural impact of the FP on European economic and research landscape"

(Report of five year assessment panel of FP6 "Ormala report")

" … John Marburger disclosed a dirty little secret: We don't know nearly enough about the innovation process to measure the impact of past R&D investments much less predict which areas of research will result in the largest payoff to society. He challenged social scientists to do better. "

(Science 21 April 2006)

Evaluation of return on investment in research organizations is tricky:

(1) The higher the potential value the more difficult it is to assess

Stage	Institutes / Funders	Value at time of investment	Potential impact of investment	Lead time for impact
Fundamental Research	Few - More public funds	Intangible – No monetary measure	Unpredictable - Nothing to enormous	decades
Applied Research				
Development	Numerous – More private funds	Tangible and intangible – Monetary measure (e.g. net present value)	Planned - Incremental	years

(2) Several key performance factors facilitate evaluation of impact, others have the opposite effect.

- Quality of vision and implementation
- Peer review
- Built-in evaluation and accountability mechanisms
- Bottom up proposals …… Input more unpredictable
- Training of new scientists …… Impact leveraged but delayed
- Cross-border collaborations …….... Outcome more diffuse
- Encouragement of dissemination of results (public research)

Less micro-management and overheads

Evaluation of return on investment in Research funding organizations First conclusion

- Return on investment consists primarily in the creation and diffusion of knowledge and training of new scientists

  > A monetary measure of impact is not appropriate

- The impact of funded research may materialize well after the end of the financial support and at unexpected locations

  > a permanent link between funders and funded research would solve the critical issue of traceability.

Track the fate of intangible asset « knowledge »

Scientific and technical knowledge lies with researchers and materialises as books, publications, lectures, patents etc that circulate in the technical and scientific sphere and recycled into new ideas, like « building blocks ».

These « blocks » are increasingly in digital format and circulate through internet. Using internet tools they can be « tagged » with the identity of relevant funding organization(s) and institution* and their diffusion be traced like « packets » of data in an internet communication.

With this technique, contribution of individual organizations to knowledge creation and diffusion becomes traceable and could be evaluated retrospectively with a fine resolution.

The time unit between investment in research and impact ranges from years to decades.

*like publications are tagged with author's reference in digital publishing

Proof of concept through example of two different strategies

- **Strategy of Standardization of document format:**
  - **Example of CML (Chemical Markup Language):** “managing molecular information using Internet tools capable of holding extremely complex information structures and so acting as an interchange mechanism or for archival”.

- **Strategy of « Metalanguage » to cope with diversity of document structures**
  - **Example of XBRL (Extended Business Report Language)** : metalanguage developed to enable comparison and compilation of business and financial data reported according to different company formats and national accounting standards.

    - Concept initiated by Charles Hoffman in 1998
    - Currently administered by an international not-for-profit consortium of 450 members.
    - Endorsed officially by OECD in October 2004
    - Development in Europe supported financially by a grant from FP6

Evaluation of return on investment in research funding organizations

Conclusion

Current evaluation of research funding organizations do not satisfy the needs of policymakers and non specialists who want to know the societal impact of research.

With modern internet technology, the contribution of a research organization to societal impact of a discovery may be apprehended when it becomes apparent even belatedly.

To be effective in a highly interconnected and diverse scientific community this approach should be « universal » and initiated bottom up by a consortium of authoritative stakeholders.

All this is realistic, feasible and efficient as proven in other fields, and someone must already be working on it !

Outcomes from research and from art are alike: intangible but materialised by « documents » which may have very different societal impacts.

My neighbours daughter

Jean-François Millet