LISIS LABORATOIRE INTERDISCIPLINAIRE Sciences Innovations Sociétés

Challenges of Research Impact Assessment for addressing Societal Challenges

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The three questions addressed

- Science policy: Impact vs. Excellence?
- How to assess impact: Qualitative approaches vs. Quantitative evidence?
- Impact assessment and research management: Auditing vs. Learning?

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SCIENCE POLICY: IMPACT VS. EXCELLENCE?

Science policy: Impact vs. Excellence? (1)

The traditional imaginary: The republic of science as the source of prosperity

"Scientific progress on a broad front results from the free play of free intellects, working on subjects of their own choice, in the manner dictated by their curiosity for exploration of the unknown." (Vanevar Bush)

"Any attempt at guiding scientific research towards a purpose other than its own is an attempt to deflect it from the advancement of science (…) You can kill or mutilate the advance of science, you cannot shape it." (Michael Polanyi)

The counter narrative: responsibility of scientists

Frederick Soddy (Nobel Prize of Chemistry – 1921) – responsibility of scientists in relation for the applications of their discoveries. Unpredictability is not a good reason for not envisioning the possible impacts of research.

Science, The Endless Frontier (Vannevar Bush Report, 1945)-- the goose with the golden eggs

New Scientist, 99 (21 April 1983), 142

Science policy: Impact vs. Excellence? (2)

The new political motto: research and innovation are needed to address grand societal challenges

- **Threats**:
  - Narrow understanding of research performance may (i) kill creativity,(ii) lower long term performance, and (iii) make this profession far less attractive.
  - If “addressing societal challenges” constitutes no more than an empty promise, we may fear that the boomerang effect will be devastating.
- **Opportunities**:
  - the research community may integrate an authentic sense of responsibility,
  - it may engage with social needs and social actors, collectively reflect on (and renew) public values of science.

Science policy: Impact vs. Excellence? (3)

"We have an obligation and an incentive to be much better at understanding and communicating the impact of what we do. Not only to ministers of finance, but to the general public!"

"So, we can have a culture that, on the one hand, promotes the measurement of the impact of research, while on the other hand, understanding, intellectually, that not all research will have a concrete and immediate impact."

Science policy: Impact vs. Excellence? (4)

First proposition

Impact is not against excellence but excellence do not necessarily product societal impact.

The key question is

Not

For or against

But

How to design research impact assessment?

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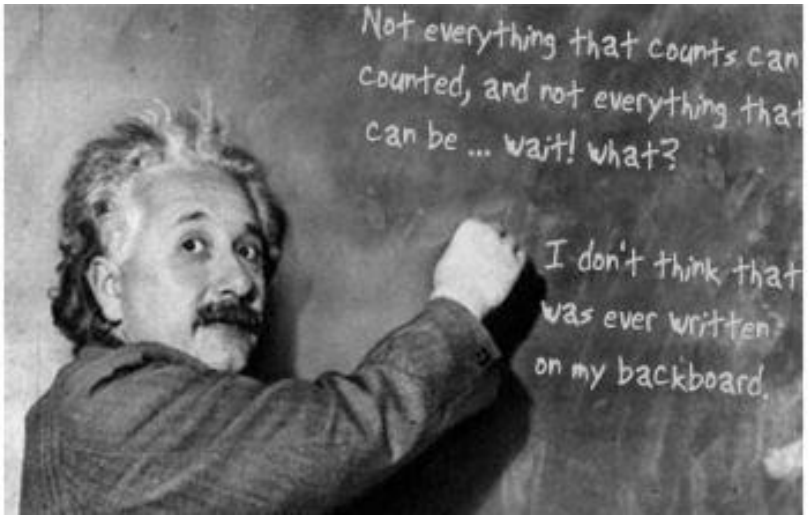
HOW TO ASSESS IMPACT? QUALITATIVE APPROACHES VS. QUANTITATIVE EVIDENCE?

How to assess impact? Qualitative approaches vs. Quantitative evidence?(1)

"Not everything that can be counted counts,

and not everything that counts can be counted."

(Albert Einstein)



However, do not forget the magic power of numbers!

Ted Porter *Trust in Numbers*

How to assess impact? Qualitative approaches vs. Quantitative evidence?(2)

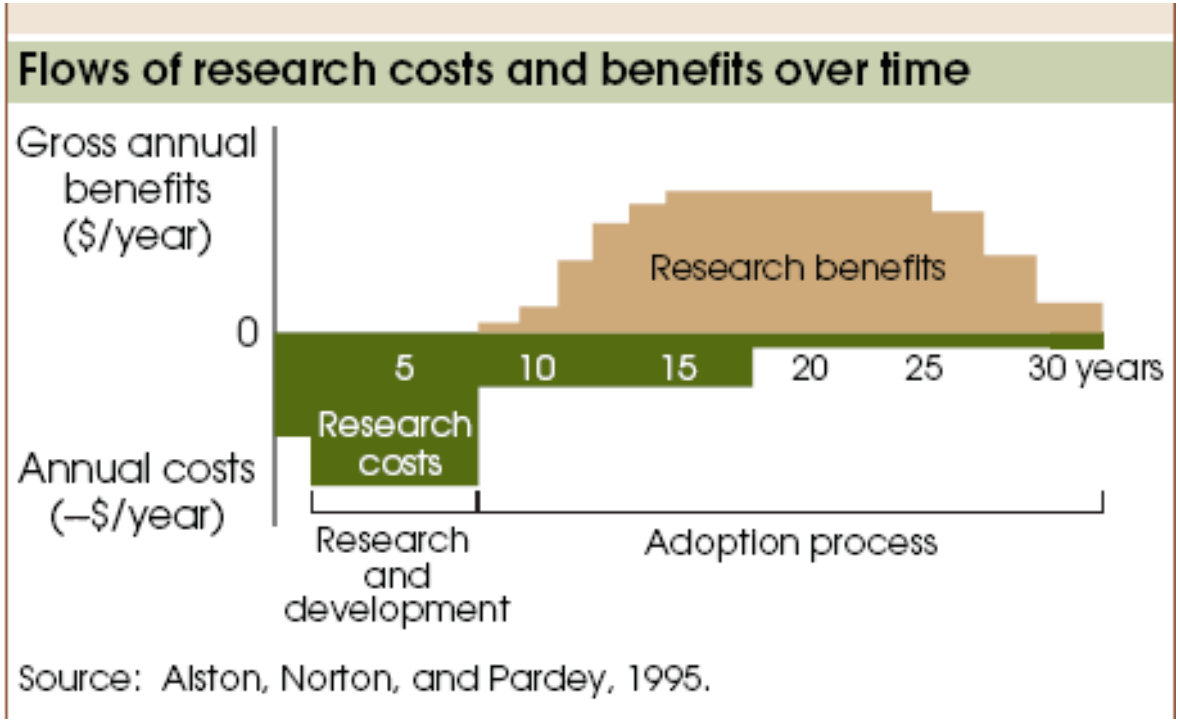
Science of science and promises of evidence based policy

- The myth of Internal Rate of Return (IRR)
- The myth of experimental methods
- The myth of big data

- The myth of IRR

Let us measure the economic return of investment in research and allocate the resources accordingly

Example of agricultural research



IRR is the discount value r such that the Net Present Value is equal to zero

$$NPV = \sum_{t=0}^{T} \frac{Benef_t - Invt_t}{(1+r)^t}$$

The rate of return to agricultural research is very high:
1000 estimates; mediam IRR above 42% (Alston et al. 2000).

Three main limitations

1. Results heavily depend upon the choice of parameters and hypothesis

Alternative computation: the MIRR method

The computation of Modified Internal Rate of Return (MIRR) assumes that only part of the economic benefit generated by the innovation is re-invested in research.
Hurley et al. (2014) re-examined more than 2 000 estimates and calculated a median MIRR of 9.8%.

Three main limitations

1. Results heavily depend upon the choice of parameters and hypothesis
2. One key assumption of models is the stability of structures – while structural change is often critical to policies
3. IRR focuses only on economic impact – while societal challenges point to a broader set of public values

- The myth of experimental methods

Let us design protocols to reveal the impact of research with a method of RCT (randomized control trials)

Limitations

- Validity of RCT depends on a set of conditions that do not correspond to research or innovation:
  - direct and rapid effects
  - Simple causalities
  - Availability of control groups

- Hype effect on RCT

« There has been this fashion during the last couple of years on the RCTs. We even heard colleagues, good colleagues, saying that in the field of development, and in the field of development aid, the only fruitful approach from now on was to do random control trials in all possible fields of interventions. And at the end, we'll have a huge map, a huge catalogue saying "This works, this doesn't work". This is crazy! This will never work and, because of that, we absolutely need the other approaches to evaluating policies and programs. The "pure, scientific evidence" on all what is concerned with development is simply completely impossible. We have to live with this imperfect knowledge. »

(F; Bourguignon, ex 1st VP of World Bank, AFD Conference in Paris, March 2012)

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- The myth of big data

Digitilisation of many sources will provide access to evidence on research impact. Data mining and computation of 'traces' is the solution.

“No longer do we necessarily require a valid substantive hypotheses about a phenomenon to begin to understand the world…In place of the hypothesis-driven approach, we can use a data-driven one. Our results may be less biased and more accurate, and we will certainly get them much faster” (Mayer-Schonberger and Cukier, 2013, p. 55)

Two main limitations

- What counts and what is counted
  - Many data on a limited set of outputs: scientific publications and patents.
  - A high proportion of data on processes, outcomes and impacts are not publicly available
- The temporality of impact is very long. The homogeneity of data on long period requires long and sustained investments.

How to assess impact? Qualitative approaches vs. Quantitative evidence?(3)

Qualitative approaches are also limited: anecdotal evidence, uncommensurability, issue of representativity and extrapolation

How to match qualitative approaches and quantitative evidence?

The example of ASIRPA

(Assessing Societal Impacts of Public Agricultural Research):

- A methodology of ex post impact assessment
- Based on case studies
- Paying attention to the diversity of values

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- **Three basic considerations for the design of the approach**
  - ***The distribution of impact is highly asymmetric***

  / Ex post, a reduced number of cases can allow to capture a high proportion of the impact of a single organisation

  - ***Impact is produced by a set of complex interactions within dynamic networks***

  / Need to understand the **contribution** of the different actors of the network

  - ***The "project" is not the relevant level of analysis (Problem of project fallacy)***

  / Construction of case studies staring from observed impacts

- **A major challenge: how to shift from individual case studies to general lessons?**

  / Systematic use of three tools: Chronology, Impact pathway, Multidimensional measure of impacts

  / Codification of cases, construction of database

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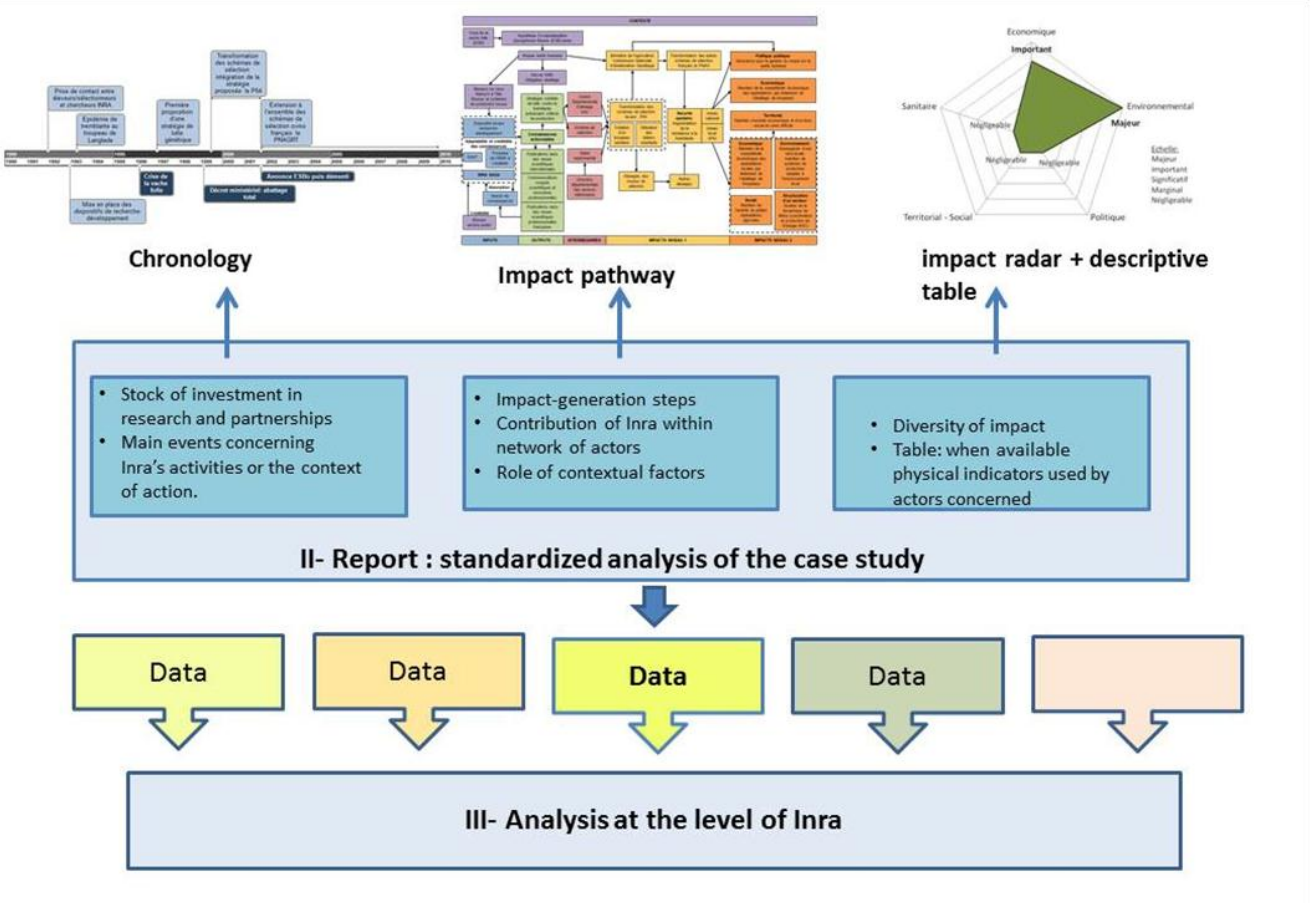
Quali/Quanti: Standardization of case studies

I- Case selection: criteria

- **Significant case- diversity – reasonably recent (publication less than 15 years)**



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- Understanding the mechanisms that generate impact

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The revised impact pathway

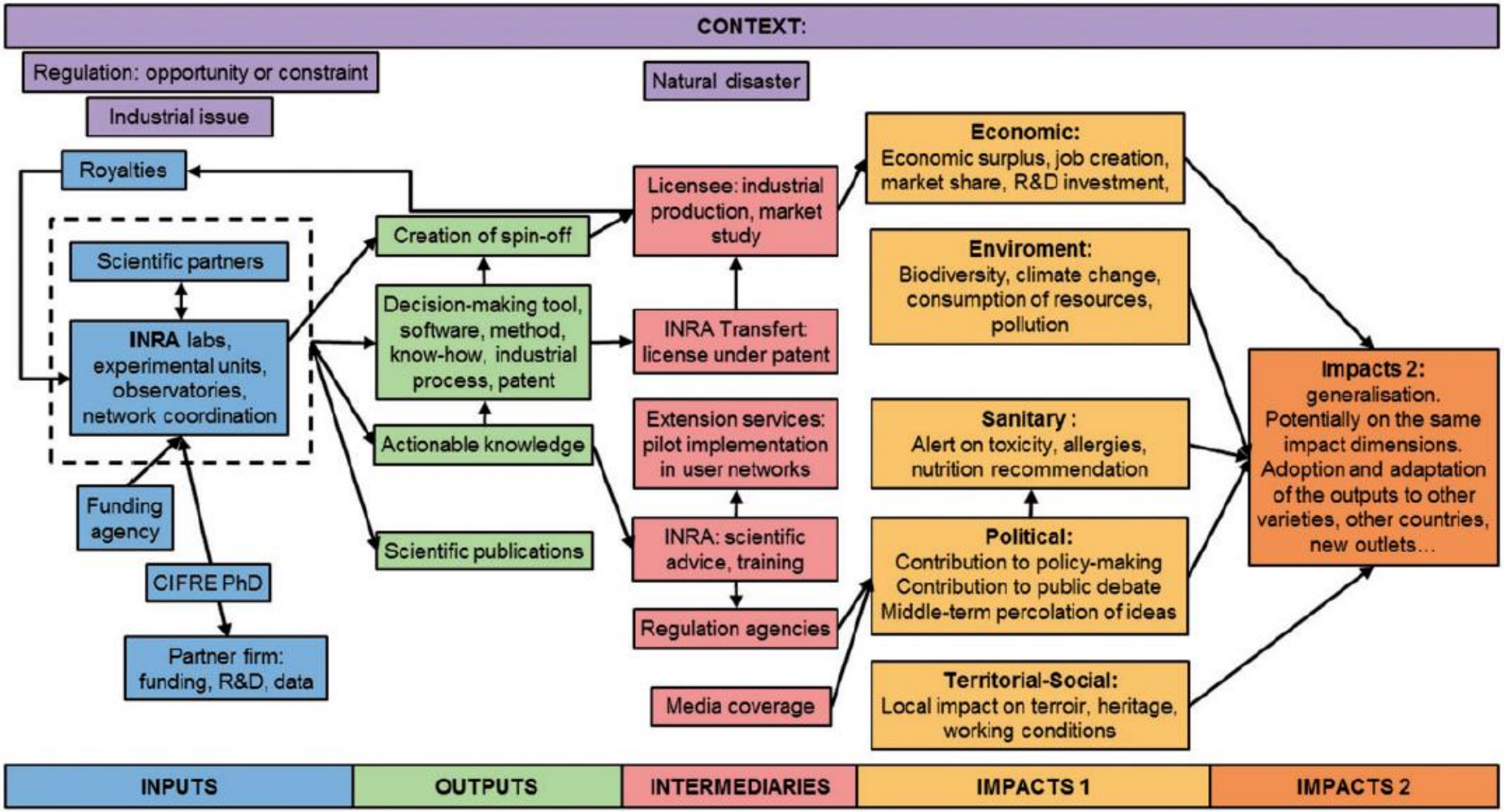

Figure 2. A fictive impact pathway according to ASIRPA.

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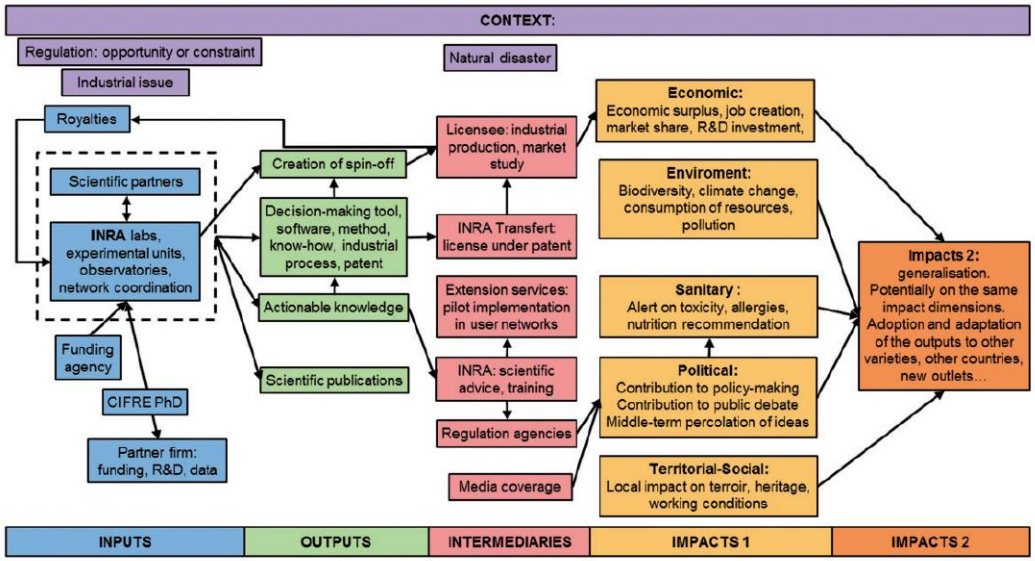

Figure 2. A fictive impact pathway according to ASIRPA.

A processual and contextual analysis:

- That aims at identifying actors and *productive interactions*
- That takes into account synergetic and systemic effects
- That allows to identify the *contributions* of different actors to the generation of impact

- Understanding the mechanisms that generate impact
- A systematic assessment of the different dimensions of impact

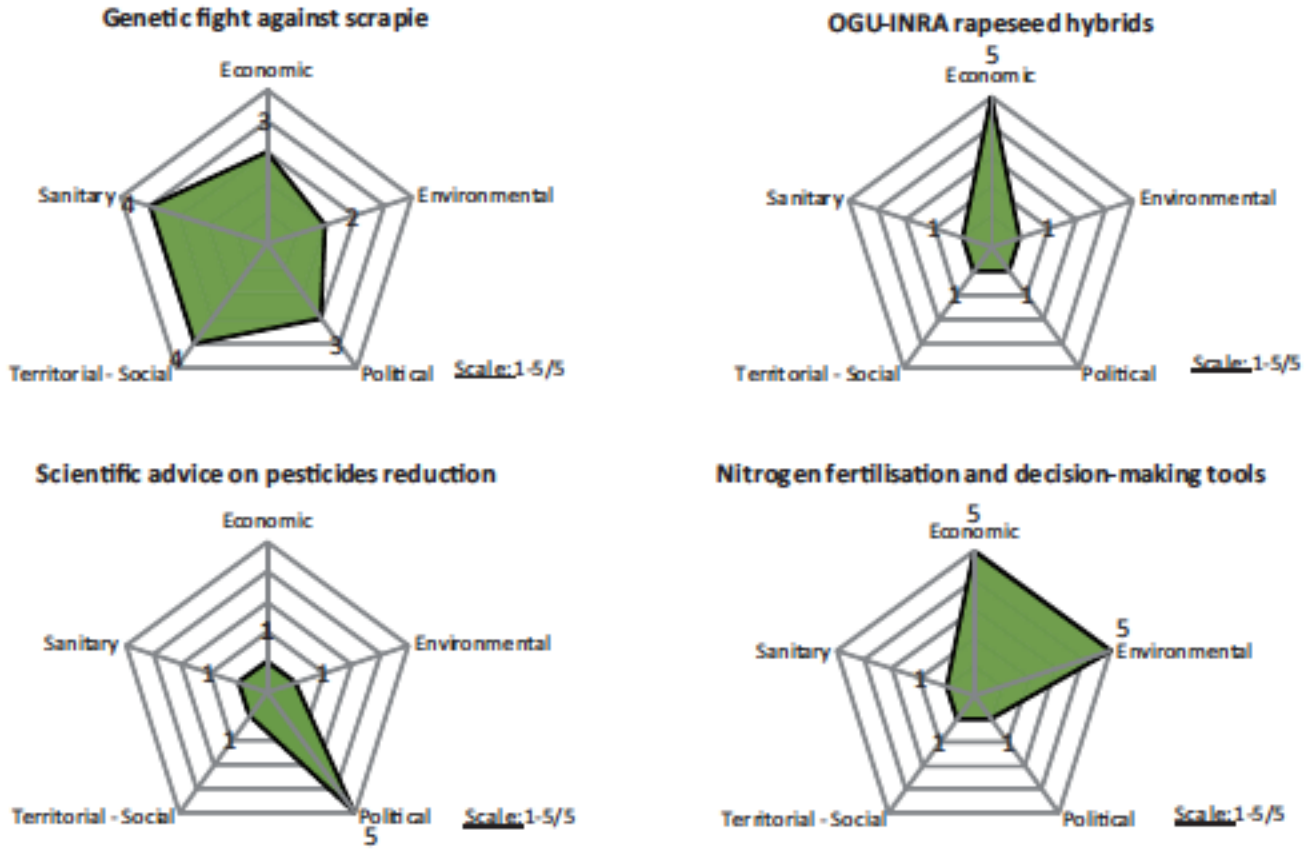

Figure 3. Example of impact radars from ASIRPA case studies.

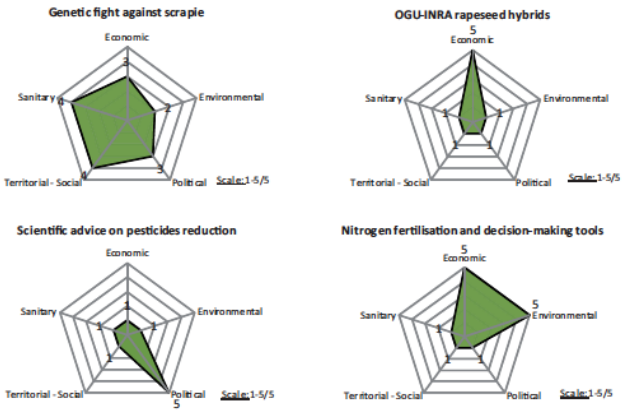

Figure 3. Example of impact radars from ASIRPA case studies.

A methodology designed to:

- Take into account the different ***values*** of research
- Allow comparability

We propose a methodology to produce qualitative standardised measures on the basis of local descriptors used by actors involved

Lessons learned

- General characteristics of Inra's impact pathways
  - Distribution of impact is highly skewed
  - Time lag 19.9 years
  - Diversity of impacts related to Inra's contribution

- Diversity of impact pathways

A typology of impact pathways

Table 5
The four ideal-types identified based on 32 case studies.

Low	Co-production of knowledge Index: Index <8	Co-production of knowledge Index: Index >8	High
	Type 4: Public research as key initiator of intensive transformation • Management of agricultural water pollution in Brittany • Alert on Bisphenol A • Defining catch quotas for Atlantic salmon • Decision-making tools for food packaging safety • Wheat rustic variety and low inputs itineraries • **Assessing the effects of pesticides on bees (example detailed below)**	Type 1: Intensive transformation drawing on existing networks • OGU-INRA: creation of rapeseed hybrids • Biocontrol of codling moth • Genetic fight against Scrapie • Indicators of Animal Well-being • Fire Paradox: integrated fight against forest fire • Scientific Public Expertise on Pesticides • Diagnostic tools for certifying potato seed plant heath • **Genomic Bovine selection (example detailed below)** • The Ecophyto public policy to reduce pesticide use • Nitrogen fertilization and decision-making tools • Infosol: information system on French soils	High Index >7
			Transformation of user sphere Index
	Type 3: Market for technologies • Ariane Apple resistant to scab • Detection of biofilms: FS-sensor • Fight against biofilms: Biorem detergent • Replacement of marine by plant ingredients in fish diets • Naskeo: start-up on biogaz production • Platanor®: plane accessions resistant to canker stain • **Nod and Myc factors: molecules to increase crop yield (example detailed below)**	Type 2: Strong collaboration in long term research programs • Tartaric stabilization of wine by electrodialysis • The CAPSIS platform of models of forest growth • The impact of climate change on French agriculture • Inventory method for agricultural N_2O emissions • **Genetic improvement of Maritime Pine (example detailed below)** • Protection against Pine Processionary • Liming against forest decline • Photoperiodic control of small ruminants reproduction	Index <7
			Low

ASIRPA in the making

	Prototype 1/2011-12/2012	Pilot 1/2013-12/2014	Implementation 1/2015 - (…)
Productive configuration	. Inra scientists . 2 junior researchers . International Scientific Committee	. Inra scientists . 1 junior researcher . Contribution of Inra's evaluation division (DEV) and scientific divisions	. Inra scientists . 1 permanent position in DEV division dedicated to implementation . Contribution of scientific divisions
Outputs	. Methodological package . 14 pilot cases . Asirpa International Conference	. 19 additional cases . Transversal analysis . Final report . Presentation Intl Conferences . Journal articles	. 8 additional cases . Methodological package improved . Journal articles . Asirpa National and International Conferences
Outcomes		7 Inra Scientific divisions used ASIRPA approach	. Implementation in Inra . Transfer to other organizations . Collaboration with OECD

Methodological challenges:

- Improve the metrics for non economic dimensions of impact
- From *ex post* assessment to *ex ante* and *in itinere*
- Develop crowd sourcing methodologies

Need to reinforce the community of professionals

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IMPACT ASSESSMENT AND RESEARCH MANAGEMENT: AUDITING VS. LEARNING?

Impact assessment and research management: Auditing vs. Learning? (1)

Grand Societal Challenges:

- Disruptive systemic change
- Wicked situations

Impact generation mechanisms:

- ***The project is not the relevant level***

/ The need to characterise **innovation fields** (role of incumbents, intermediaries, etc.)

- ***Contribution in a complex web of interactions***

/ How to improve probabilities of **generalisation**?

- ***The time lag from research to impact is very long***

/ How to speed up innovation processes?

- ***Lessons from transitions studies***

/ Possibilities of hybridization

/ Need to overcome incumbents resistance (de-alignment / re-alignment processes)

Impact assessment and research management: Auditing vs. Learning? (2)

Power (2007). Audit Explosion

STYLE A	STYLE B
Quantitative	Qualitative
Single Measure	Multiple Measures
External Agencies	Internal Agencies
Long Distance Methods	Local Methods
Low Trust	High Trust
Discipline	Autonomy
Ex Post Control	Real Time Control
Private Experts	Public Dialogue

Impact assessment and research management: Auditing vs. Learning? (2)

Impact assessment as a tool for strategic intelligence

- Appropriation of the approach by those who are evaluated (tools that are appropriate, training, interest for meta-analyses)
- Multiple measures that take into account the diversity of goals and the diversity of roles
- High trust and reinforcement of collective competencies
- Improvement of public dialogue on the public values of science

Thanks for your attention!

To know more about ASIRPA

http://www6.inra.fr/asirpa/

A. Gaunand, A. Hocdé, S. Lemarié, M. Matt, E. de Turckheim, 2012. How does public agricultural research impact society? Towards a characterization of various pathways. Research Policy 44, 849-861. doi:10.1016/j.respol.2015.01.009

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