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Assessing the impact of state interventions in research – techniques, issues, solutions

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Road map

- What is impact analysis and why do we do it?
- Issues in impact analysis
- Approaches – what's new and interesting?
- Where do we go from here?

Nature and purpose of Impact Assessment (IA)

- May be *ex post* or *ex ante*; either way can cause 'observer effects'
- Logically narrower than evaluation, but the boundary is fuzzy
- It's part of the evaluation and management activity of the policy cycle – so it's a managerial tool and not done for its own sake
- IA is a theory-based activity
  - *Not only in the sense of being based on a theory of change*
  - *But also in the sense that 'theories of change' depend upon beliefs and theories about how impacts come about*
- Since the context affects the way interventions operate, IA needs to consider context and not only the intervention
- The idea of 'impact assessment' is inherently linear. The impacts of research and innovation aren't …

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But if we stick with the idea of 'impact assessment', there are perhaps six kinds of mechanisms to consider

- Industrial innovation (including innovation in agriculture and services as well as products and processes)

- Research-influenced changes in policy, agenda-setting

- Tackling 'grand' or societal challenges, that impede social and economic development or provide existential threats (e.g. climate change)

- The provision of improved public goods (and potentially the provision of associated state services)

- The improved exercise of professional skill, for example in research-based improvements in medical practice

- Human capital development – which is not orthogonal to the other categories but tends to feed into them

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The use of grand challenges to organise research and innovation funding has important consequences

- They focus on problems on the 'demand side' of scientific and technological change, so they are inherently governed or steered by society rather than by 'science'

- Their breadth (especially in the European variant) means that they often cannot be tackled by a single Department, Ministry or funding agency, creating new issues of governance and opening the question: Who is responsible for impact assessment?

- Their problem focus makes the basic/applied research distinction functionally meaningless in addressing the challenge – there is no way to specify in general the degree of wholly new or fundamental knowledge that is required to solve challenges

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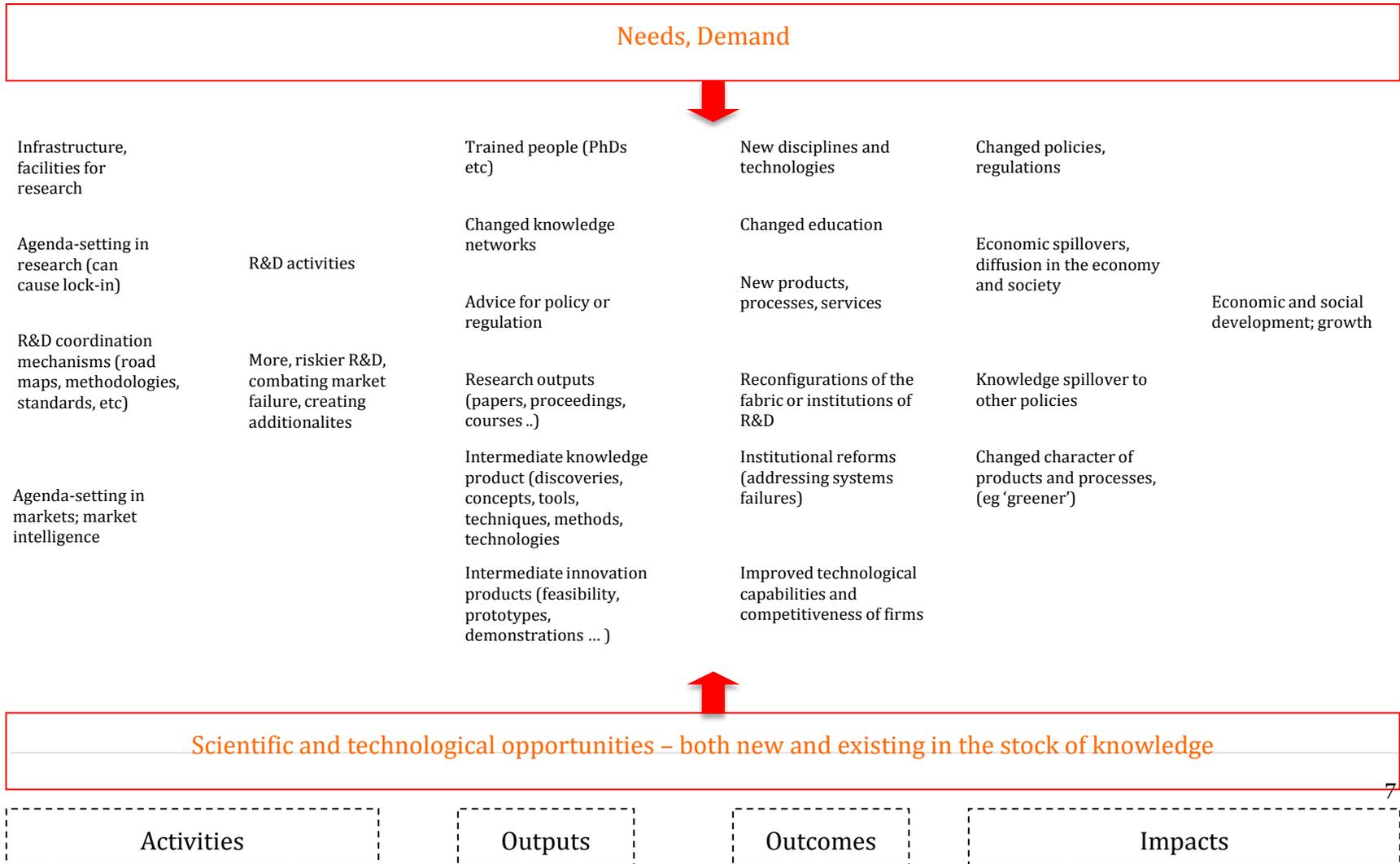# We tend only to pay lip service to human capital impacts

- Human capital development is a key ingredient of traditional justifications for higher education and research
- The literature on the role of human capital in research is largely ignored in impact analysis
- Human capital has been proposed as an alternative indicator of research impact for the purposes of evaluation
- Some theoretical developments lend themselves well to impact analysis but are little explored

Bozeman, B., Dietz, J. S., & Gaughan, M. (2001). Scientific and technical human capital: an alternative model for research evaluation. *International Journal of Technology Management , 22* (7), 716-740.
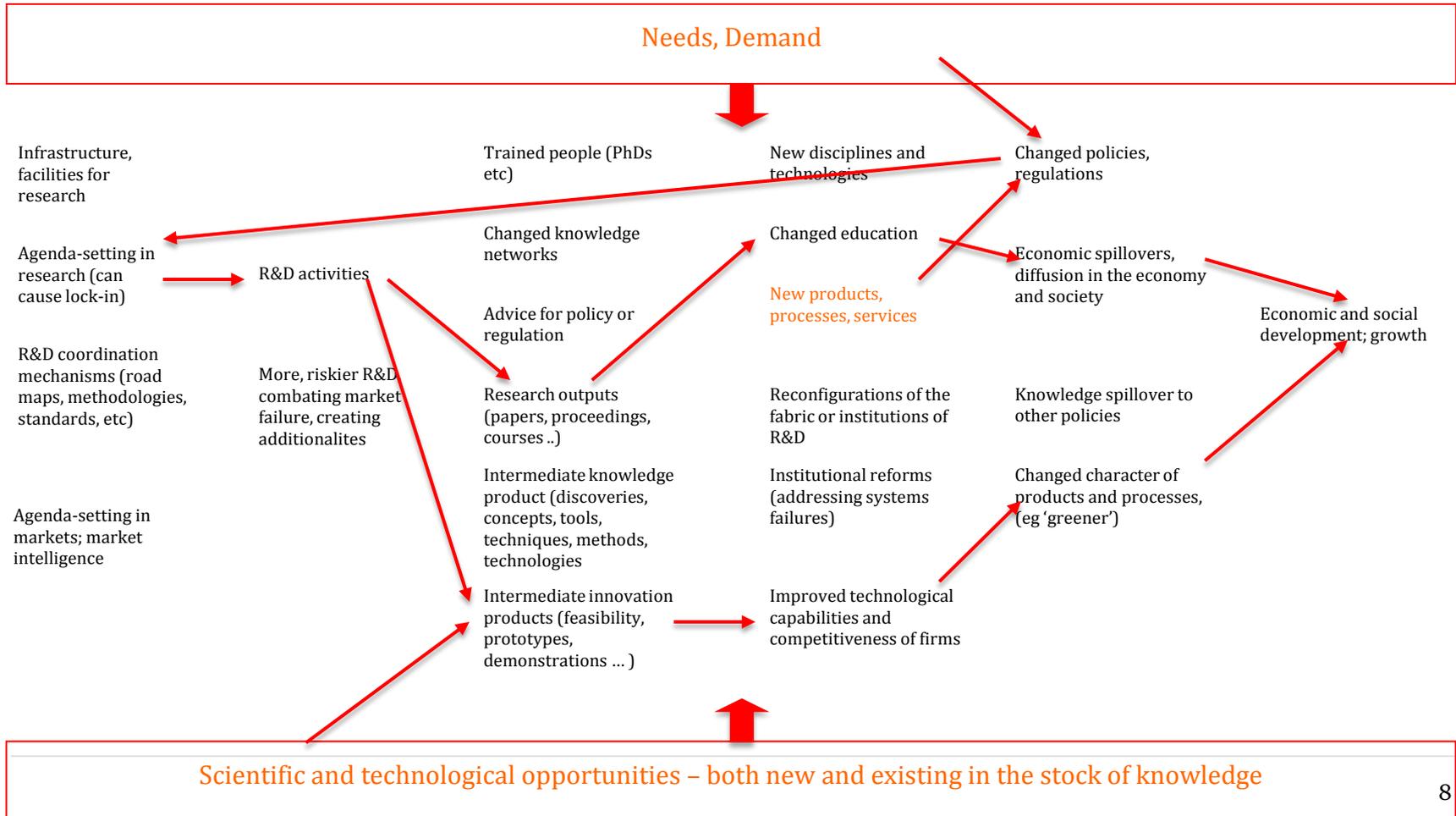
Bozeman, B., & Rogers, J. D. (2002). A churn model of scientific knowledge value: Internet researchers as a knowledge value collective. *Research Policy , 31*, 769-794.

Arnold, E., Good, B., & Segerpalm, H. (2008). *Effects of Research on Swedish Mobile Telephone Developments: The GSM Story, VA2008:04.* Stockholm: VINNOVA.
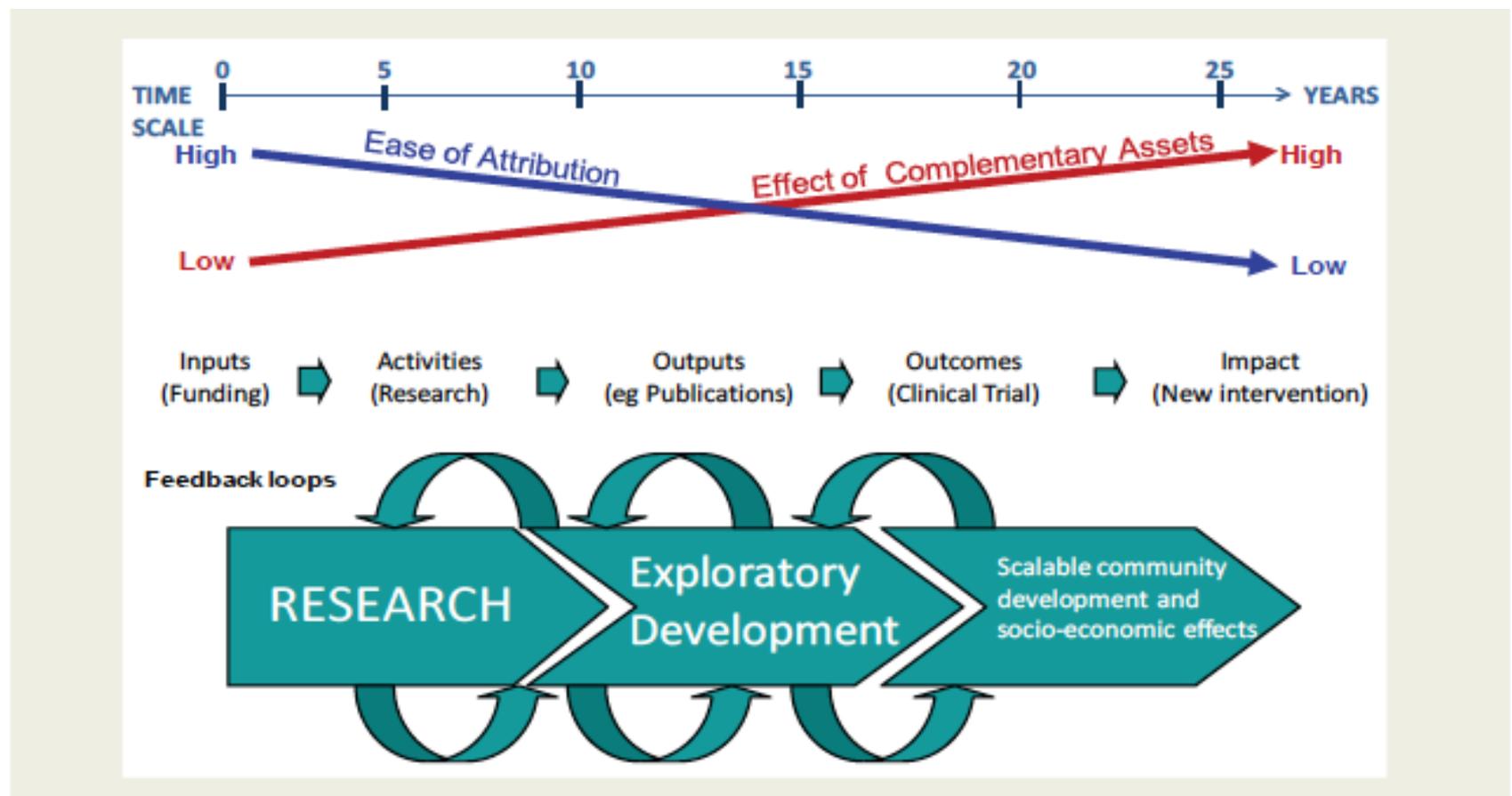
We are addicted to linear impact models

Needs, Demand

Infrastructure, facilities for research

Agenda-setting in research (can cause lock-in)

R&D activities

R&D coordination mechanisms (road maps, methodologies, standards, etc)

More, riskier R&D, combating market failure, creating additionalites

Agenda-setting in markets; market intelligence

Trained people (PhDs etc)

Changed knowledge networks

Advice for policy or regulation

Research outputs (papers, proceedings, courses ..)

Intermediate knowledge product (discoveries, concepts, tools, techniques, methods, technologies)

Intermediate innovation products (feasibility, prototypes, demonstrations ...)

New disciplines and technologies

Changed education

New products, processes, services

Reconfigurations of the fabric or institutions of R&D

Institutional reforms (addressing systems failures)

Improved technological capabilities and competitiveness of firms

Changed policies, regulations

Economic spillovers, diffusion in the economy and society

Knowledge spillover to other policies

Changed character of products and processes, (eg 'greener')

Economic and social development; growth

Scientific and technological opportunities – both new and existing in the stock of knowledge

Activities	Outputs	Outcomes	Impacts

It's time to grow up

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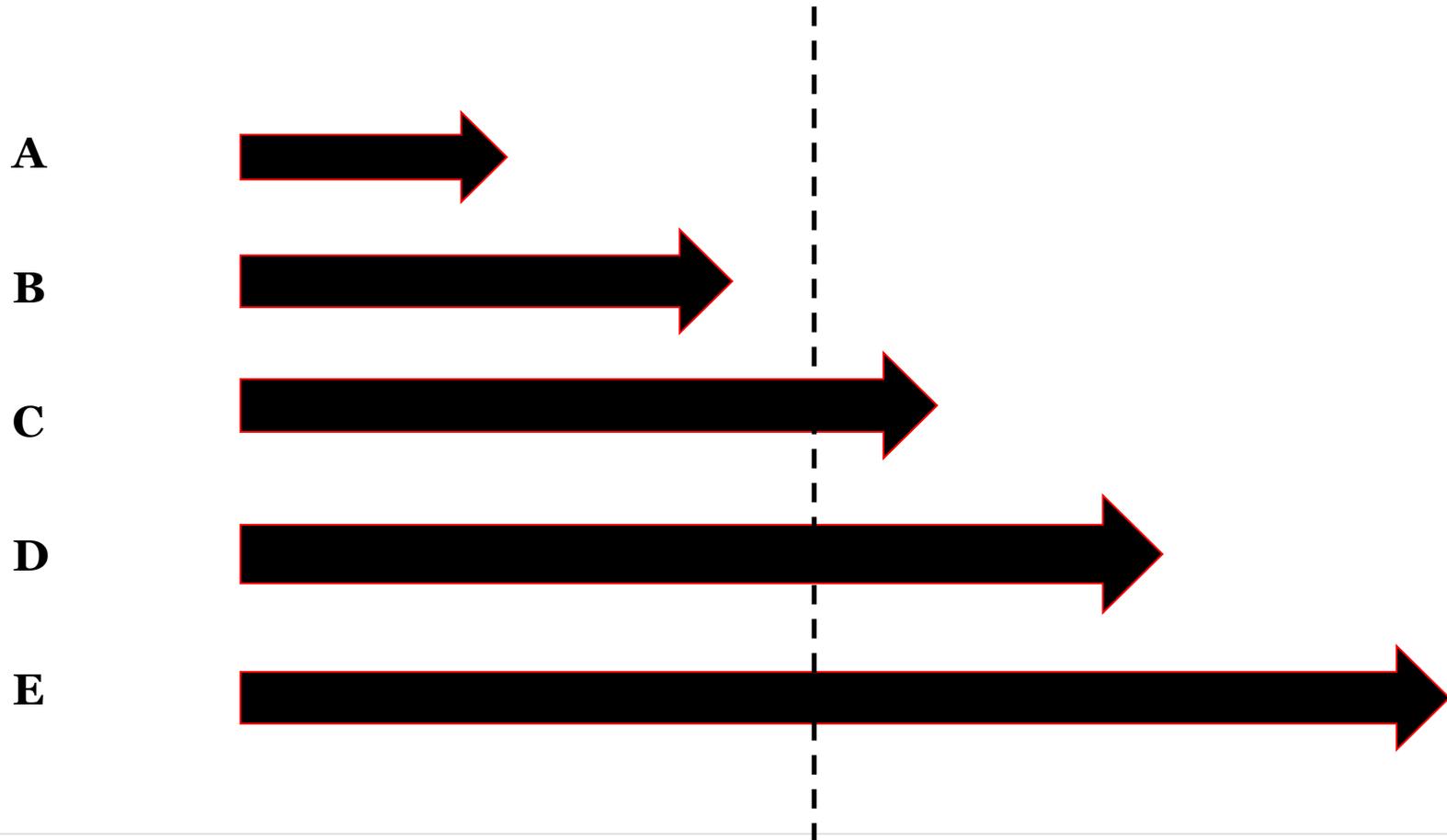
8

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Issues in Impact analysis

- Causality
  - *Dead weight, net effects and the counter-factual*
- Attribution and multiple causality
- Circular causality
  - *Including 'endogeneity' in econometric analysis*
- Difficulty and hence unreliability of making valid effectiveness comparisons
- Skew and serendipity
- Non-substitutability of interventions, so searching for the one with the biggest RoI rarely helps determine policy
- Timing of impacts

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The joy of attribution ...

Hughes, A., & Martin, B. (2012). Enhancing Impact: The Value of Public Sector R&D. Cambridge: UK-IRC, Hudge Business School

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As in so much of life, timing can be everything ...

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And it can take a **long** time!

- Some of the most interesting evidence about the importance of basic and applied research comes from the budget rivalry between the US National Science Foundation (NSF) and mission-orientated research in the 1960s

- The US Department of Defence commissioned the Hindsight study, which traced the research antecedents of a number of weapons systems back for twenty years or so and concluded that the underpinning research was largely mission-orientated in nature

- NSF retorted with the TRACES study, which traced backwards for up to fifty years from five important civil innovations and found critical connections to basic research

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Issues for multiple impact assessments

- Identifying and testing overlaps in intervention logics
- Multiple causality
    - *More than one intervention may have impact*
    - *How to combine or attribute responsibility when steps in the logic are 'necessary but not sufficient'?*
- Difficulties in finding 'clean' control groups in developed countries
- Avoiding multiple counting – otherwise you get the paradox that the more impact analyses you do, the bigger the total impact

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Where are the methodological developments taking place?

- Following the money
  - *Computable general equilibrium (CGE)*
  - *Production functions*
  - *(Micro)econometrics, control group analysis*
  - *Cost-benefit analysis*
  - *Randomised Control Trials*
- Understanding impacts
  - *Tracing*
  - *Surveys, interviews*
  - *Case studies*

- Focusing on particular outcomes
  - *Human capital*
  - *Scientometrics*
  - *Altmetrics and webometrics*
  - *Social Network Analysis*
- Impact assessment for performance measurement
  - *Eg university performance-based research funding systems*
- Mixed-methods approaches

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Impact analysis impacting reality: emerging conclusions on performance-based research funding systems

- There's not much evidence behind the policy trend to PRFS
- Policy purposes seem rarely to be made explicit
- If you dig, you can find them
  - *UK: Matthew effect*
  - *CZ: Overcoming governance failures*
  - *NO: Quality reform of the whole system*
- PRFS are high-leverage interventions
  - *Behaviour change drivers are probably career and status*
  - *Possible to use them without destabilising institutional funding*
- Highly prone to gaming and unintended effects
- Longer-term risks include 'normalisation' of science and research (Kuhn), changes in cooperation behaviour and undermining academia/rest-of-society links

Some take-home ideas (1)

- Impact analysis is a policy-driven activity, not a science
- The idea of 'impact' remains problematic and we have no proper philosophy of causality
- Our models are too linear
- We need better (theoretical) understanding of social effects in relation to new knowledge
- There are neglected areas, including public goods, improving skills and other aspects of human capital
- Impact analysis too rarely respects a key principle of evaluation: multiple methods
- One of the hardest things is the counter-factual. Even when we find a proxy for it, the proxy is still a proxy

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Some take-home ideas (2)

- We need to understand more about observer and Hawthorne effects and the ways beneficiaries and survey respondents game the impact analyses
  - *Not just PRFS*
  - *But how did companies learn to quantify their responses in the early user-driven R&D surveys?*
  - *How honest are the responses when we ask for self-assessments of performance or additionality?*
- Last but not least – how do we link micro and macro approaches so that we can open up the black box of mechanisms and causality in macro impact analyses?

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Thank you

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