
IMPACT OF SCIENCE

Joint Virtual Conference

Fraunhofer-Institute for Systems and Innovation Research, Karlsruhe
Federal Ministry for Education and Research, Berlin/Bonn

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Introduction

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WHY THIS CONFERENCE – AND WHY NOW?

- Legitimacy for public investment: Periodic re-visiting
- German public debate on structure of the system and its power to „deliver“
 - often very limited view on impact
 - differentiated German system needs sophisticated evolution of impact analysis
- New academic concepts and measures to „understand impact“
- Evolving, growing demands as to what science should deliver
- Evolving mechanisms with which impact occurs

SCIENCE AS PUBLIC VALUE

MENTAL MODELS, PATH DEPENDANT DEMANDS, NEW CLAIMS

- Science based innovation as basis for economic competitiveness and growth
 - Co-generation with, transfer to economic actors - push and pull model
 - Science based firms
- Scientific insights deliver building blocks for solving societal problems
 - Scientific knowledge to understand problems and suggest solutions
 - Scientific deliberation, communication, education
 - Often translation through policy, science-policy interaction
 - **Broadening claims:**
 - System innovation and transformation
 - Increased complexity, relative role of science, multiplying interactions
- Science to make systems **resilient**
 - Impact manifest only in crises - agility (if and when needed)

IMPACT - DIFFERENTIATIONS

- Of what:
 - what kind of research- and how to differentiate?
 - basic research vs. application-oriented research?
 - specific academic disciplines?
- By whom:
 - scientific system
 - individual parts of public science (Universities, non-university research)
 - individual organisations, specific institutes
 - individual researchers
 - (private companies (co-generating public value, using public science))

COMPLEXITY OF IMPACT DEVELOPMENT AND IMPACT MEASUREMENT

- Attribution
- Combination of different scientific results/ research lines
- Contextual, systemic differences (over time)
 - Different „missions“ and identities for different types of organisations
 - different and fluctuating incentive structures
 - (negative) effects of impact measurement: Game playing, counterproductive incentives
- Complexity of mechanisms increasing with broader claims
- Challenges for organising, communicating and using impact measurement (who, when)

CONDITIONS FOR IMPACT – WHO IS RESPONSIBLE?

- Supply side (most analyses) („Bringschuld“):
 - individual scientist, research institutions, research organisations, scientific system:
 - Systemic conditions: incentive systems, capacities, governance
- User side (e.g. OSIRIS) („Holschuld“)
 - Impact through application and interaction
 - Absorption in economy, society and politics: willingness and ability

IMPACT THROUGH WHAT? MECHANISMS

- Need to understand mechanisms to
 - manage expectations
 - measure (interim) impact steps
 - to understand future intervention
- Different mechanism models co-exist: linear, chain linked, push – pull
 - direct: limited intermediation, traceable
 - indirect: mutiple steps, intermediation, hard to trace
 - Contextualised theories of change
- Time: short term vs long term impact and mechanisms

IMPACT OF SCIENCE

ARE WE TAKING THE MEANS FOR AN END?

- We monitor changes in *mechanisms*, as we *assume* making a difference as of impact („theory of change“), e.g.
 - Spin offs, start ups
 - Number of contract research projects / budgets (science – industry)
 - Number of patents, licence income
 - Quantity and type of collaboration science – industry, collaborative institutions
 - Inter-sectoral mobility of personnel, training for industry
 - Science communication activities (broader public), science – policy interaction

- What are our respective theories of change?
- What do we really know about the effectiveness and long term „impact“ of those mechanisms?
- Do we „maximise“ mechanisms for the sake of it?

WHAT „IMPACT“ ARE WE ACTUALLY LOOKING AT?

■ Economic impact

- macro level: investment in research (or specific types of research organisation) leading to changes in GDP / job creation etc.
- micro level: economic effects through :
 - cooperation with public research
 - absorbing scientists from public science
 - ...

WHAT „IMPACT“ SHOULD WE LOOK AT IN ADDITION

- Societal and policy impact, ad hoc, as / if needed, e.g.:
 - for specific purposes or crises, e.g. tracing role of science for Covid, on critical debates
 - no simple „macro“ level approach, very hard to trace (this conference.....)
 - lots of narration, plausibility,
 - no real systematic understanding of mechanisms
 - supporting and hampering factors under-explored

- System transformation impact (SDGs, Missions, Responsibility metrics)
 - supporting transformation discourses
 - enabling systems understanding, being network node in systems, making connections
 - enabling transformation pathways, providing knowledge base and technologies needed

IMPACT OF SCIENCE - CHALLENGES

- Are we be able to re-construct and characterise appropriate mechanisms for a broader impact measurement?
 - Some explicit „theories of change“, or theories of impact, even if simplified
 - Characteristics of effective mechanisms (e.g. constructive interaction, SIAMPI)
 - Impact tracing reseach, backcasting to identify mechanisms and intervening variables (ASIRPA)
- Are we then able to actually measure societal and transformational impact?
 - case studies: mechanisms leading ot impact, reporting on impact
 - quantifying, scaling up: mechanism – impact link?
 - assumptions about mechanisms the harder the braoder the claim
- Additional new organisational and method set-up needed if we are serious

THREE MAJOR QUESTIONS

- What is impact?
Processes and public values
- How to identify and interpret mechanisms?
- How to measure impact?
- How to broaden?
Integration of current debates: SDGs und Responsible Metrics

ANNEX – ALTES MATERIAL UND EIN NEUES BEISPIEL AUF ORGANISATIONSEBENE

BEISPIEL 1: UK RESERACH EXCELLENCE FRAMEWORK

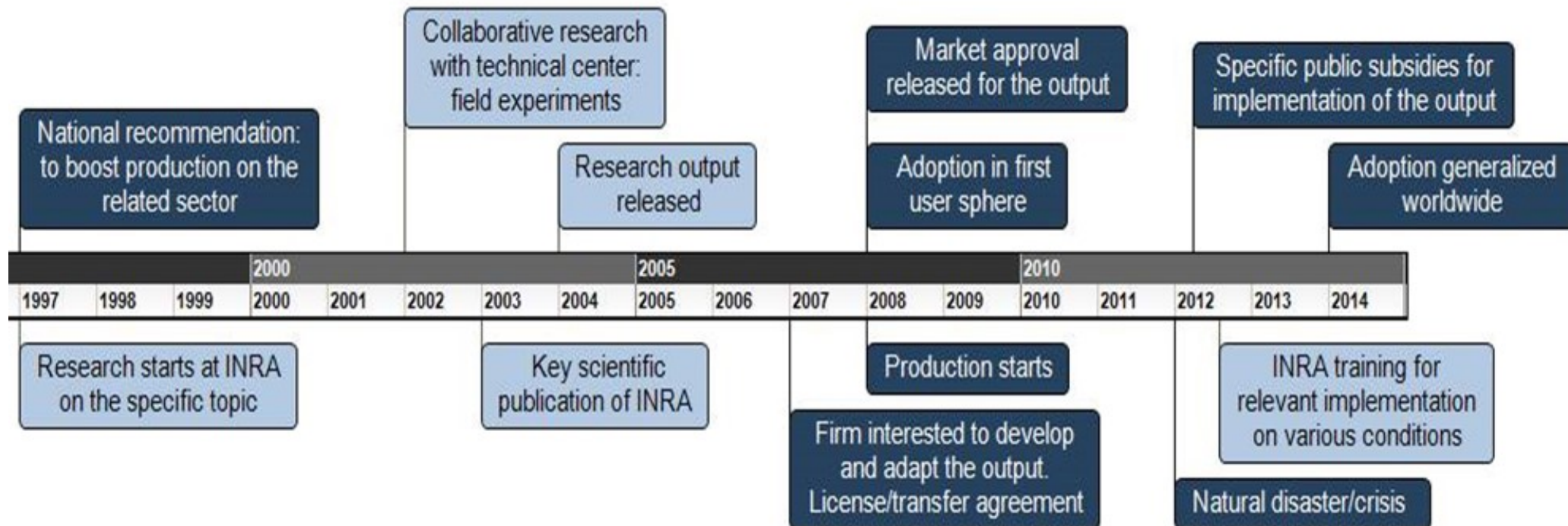
- Grundlage zur Verteilung von Forschungsgeldern an Universitäten
- Basierend auf "Exzellenz" (extrem extensiver und intensiver peer review Prozess)
- Über die Zeit "Wirkung" von Universitäten und ihren Einheiten ergänzt
- Wirkungsnarrative, von Wissenschaftlern ausgearbeitete "Cases"
- Wirkung in der Wahrnehmung der Nutzer, schriftliche Referenzen, konkretes Feedback von Nutzern
- Explizite Darstellung des Zusammenhang von Forschung und Wirkung
- **Bewertung durch Peer Review**
- Keine Aggregation, feste Proportion von Anzahl von Fällen zu Publikationen /Größe der Einrichtung
- Kein klarer Zusammenhang zwischen wissenschaftlicher Exzellenz und Impact Exzellenz
- Aber: Zusammenschau über Disziplinen, Organisationen etc. gibt Gesamtbild
- Potenziell kontraproduktive Verhaltenseffekte

BEISPIEL 2: ASIRPA (SOCIO-ECONOMIC ANALYSIS OF THE IMPACTS OF PUBLIC AGRICULTURAL RESEARCH)

- Impact von Forschungsportfolio einer Forschungsorganisation (Frankreich, Landwirtschaftsforschung, Joly et al, INRA)
- Dutzende von standardisierten Fallstudien,
 - Gehalt von Forschungsergebnissen in Endprodukten und Verfahren
 - Rückverfolgen zu Forschungsaktivitäten,
 - Analyse der involvierten Akteursnetzwerke, Wirkungsmechanismen
- Teil-Aggregation, Typenbildung

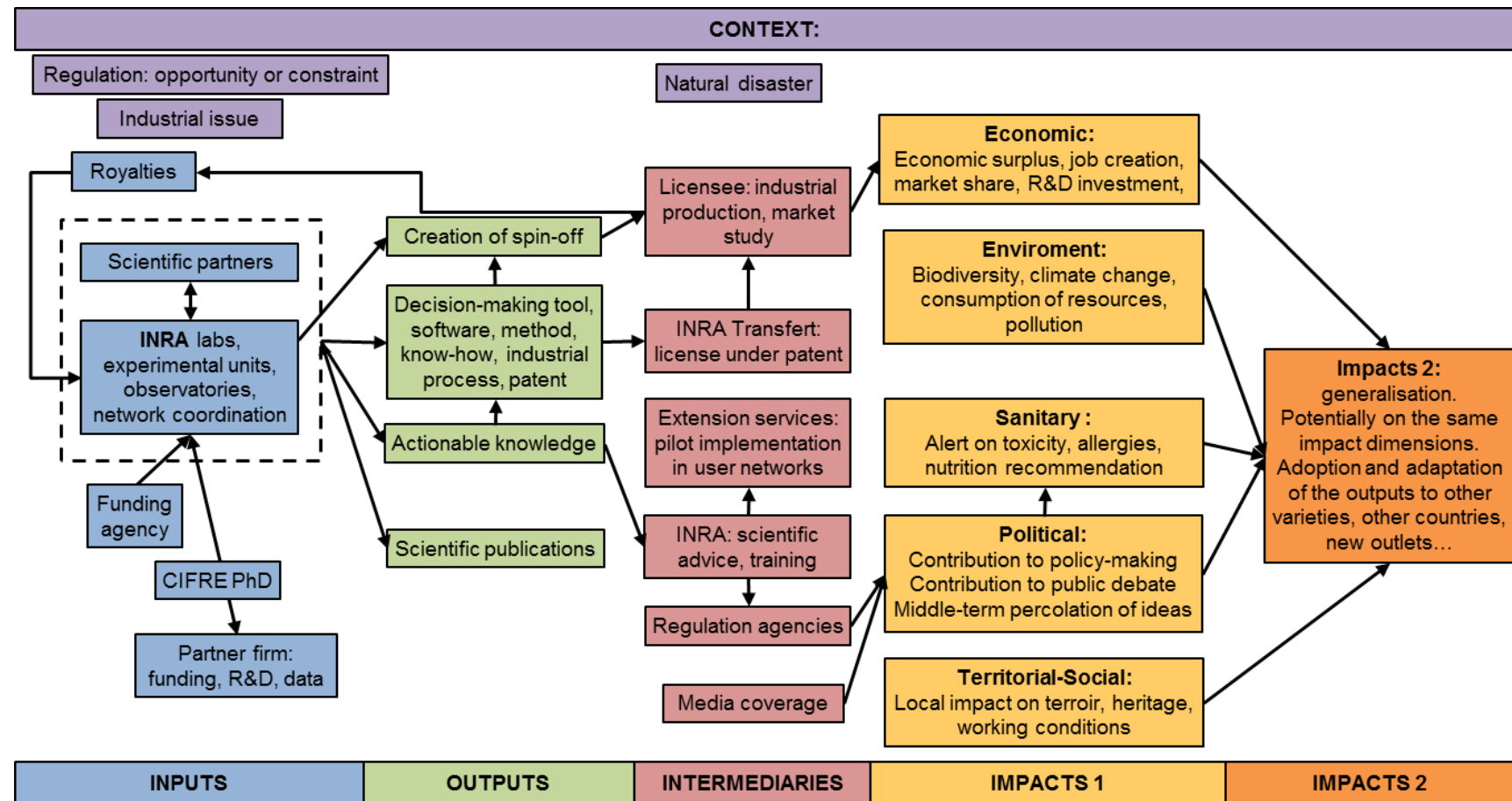
BEISPIEL 2: ASIRPA (SOCIO-ECONOMIC ANALYSIS OF THE IMPACTS OF PUBLIC AGRICULTURAL RESEARCH)

- Beispiel einer Wirkungschronologie (Ereignisse und Kontext))



BEISPIEL 2: ASIRPA (SOCIO-ECONOMIC ANALYSIS OF THE IMPACTS OF PUBLIC AGRICULTURAL RESEARCH)

■ Beispiel eines Wirkungspfades



BEISPIEL 3: ÖKONOMISCHE WIRKUNGSMESSUNG

- Beispiel 3a: §7 Bundeshaushaltsordnung (BHO)
- Beispiel 3b: EARTO: Economic Footprint of 9 European RTOs in 2015-2016
 - The focus of this study is to specifically highlight the economic footprint of Research and Technology Organisations (RTOs) based on information collected from 9 RTOs
AIT (AT), CEA (FR), DTI (DK), Fraunhofer (DE), imec (BE), Sintef (NO), TecNALIA (ES), TNO (NL) and VTT (FI)
 - Focus on: a) the economic leverage of the RTOs' core activities through spending and employment, b) the economic leverage of the knowledge transfer activities through contract research, spin-offs' creation and outflow of staff.
 - Direkter ökonomischer Impact (2016): 54.200 Jobs, 7,2 Mrd. € Umsatz, 3,5 Mrd. € Wertschöpfung
 - Indirekter Impact (2016): 284.000 Jobs, 35,8 Mrd. € Umsatz, 16,8 Mrd. € Wertschöpfung
 - darin enthalten: 287 Spin-Offs von 7 Organisationen, die 18.000 neuen Jobs geführt haben
 - Jede Stelle in einem RTO führt zu 4 Stellen in der Wirtschaft in Europa
 - Für jeden investierten Euro in ein RTO fließen knapp 3 Euro an die nationalen Regierungen zurück

VON BEDEUTUNG FÜR UNSERE DISKUSSION

- Klare Identifizierung und Kommunikation
 - was man wissen will
 - warum
 - wie
- Bewusstsein über die Messprobleme (Attribution, Quantifizierung)
- Konzeptionelle Überlegungen und Mechanismen als legitime Krücken
- ..
- ..

COMPREHENSIVE IMPACT MODEL

EXAMPLE CANADIAN INSTITUTE OF HEALTH RESEARCH

Key driver	Indicator
Research: <ul style="list-style-type: none">Increased international collaboration by Canadian health researchers and institutionsIncreased Canadian involvement in international clinical trials.Continued or enhanced access for Canadian health researchers to leading-edge technology and thinking regarding health research	The number of CIHR grants that involve international collaborators.
	The number of grants made through the International Opportunities Program (IOP) seed funding.
	The dollar value of IOP grants secured as the result of projects.
	The number of Canadian health research publications with a non-Canadian co-author.
	The number of Canadians involved in non-Canadian peer review and international researchers involved in CIHR peer review.
	The number of international Institute Advisory Board members.
	The number of international clinical trials involving Canadians.
Talent: <ul style="list-style-type: none">A Canadian health research community that is globally connected.	The number of training awards that involve a non-Canadian studying in Canada or Canadians studying in another country.
	The number of Strategic Initiative In Health Research projects that have an international component
	The number of Canadian researchers who have returned from training internationally.

COMPREHENSIVE IMPACT MODEL

EXAMPLE CANADIAN INSTITUTE OF HEALTH RESEARCH

Global Health: <ul style="list-style-type: none">• Recognition of Canada as a contributor to addressing significant global health challenges.• Health researchers in low and middle-income countries collaborating with Canadian colleagues.	The number of grants and awards made by the Global Health Research Initiative.
	Existence of the Teasdale-Corti and the Grand Challenge Programs, the number of research linkages supported by them.
	The number of countries involved in the Canada-HOPE Program and the number of scholarships provided.
Safety and Security: <ul style="list-style-type: none">• Research contributions to mitigate emerging health threats to Canadians and bio-terrorism.	The existence of a research component in Canadian government strategies aimed at combating health threats and bio-terrorism.
	The existence and functioning of the Canadian Rapid Research Response Team.
Best Practices: <ul style="list-style-type: none">• Improved policies and systems for research management at CIHR.• CIHR contribution to improving the policies and systems for research management in research organizations in other countries.• International recognition of CIHR as a leading-edge health research organization.	The number of countries that have consulted CIHR regarding research management advances.
	The number of instances in which research management advances from other countries have been adopted by CIHR.

Status Quo and Impact Illustration: The Example of the Canadian Institute of Health Research I

Status Quo and Impact Illustration: The Example of the Canadian Institute of Health Research II

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TYPES OF IMPACT AND ACTORS AFFECTED

- Wissenschaftlich, technologisch (Befruchtung, hohe Zitation...)
 - Nachhaltigkeit / Umwelt (weniger Emissionen, verträglicher.....)
 - Wirtschaftlich (Innovation, Produktivität, Wachstum, Firmengründungen.....)
 - politisch/gesellschaftlich (Entscheidungen, Diskurse....)
 - symbolisch vs. instrumentell
 - kulturell, diskursiv (Sichtweisen, Selbstverständnis....)
- Für jede Dimension Dutzende von Indikatoren bzw. idiosynkratisch festzulegende Kriterien von „Public Value“ (Bozeman/Sarewitz)