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Visible: discovering the impact of research conducted by universities of applied sciences

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APPENDIX A

Perspective	Positivist	Constructivist	Realist	Critical	Performative
Assumption about what [research] knowledge is	Facts (especially statements on relationships between variables,) independent of researchers and transferable to new context	Explanations/ interpretations of a situation or phenomenon, considering the historical, cultural and social context	Studies of how people interpret external reality, producing statements on 'what works for whom in what circumstances'	Studies that reveal society's inherent conflict and injustices and give people the tools to challenge their oppression	Knowledge is brought into being and enacted in practice by actor-networks of people and technology
Assumed purpose of research	Predictive generalisations ('laws')	Meaning: perhaps in a single unique case	Theoretical generalisation (what tends to work and why)	Learning, emancipation, challenge	To map the changing dynamics of actor-networks
Preferred research method	Hypothesis testing; experiments; modelling and measuring	Naturalistic inquiry (i.e. in real- world conditions)	Predominately naturalistic, may combine quantitative and qualitative data	Participatory (action) research	Naturalistic, with a focus on change over time and network [in]stability
Assumed way to achieve quality in research	Hierarchy of preferred study designs; standardised instruments to help eliminate bias	Reflexive theorising; consideration of multiple interpretations; dialogue and debate	Abduction (what kind of reasoning by human actors could explain these findings in this context?)	Measures to address power imbalances (ethos of democracy, conflict management) research capacity building in community partner(s)	Richness of description; plausible account of the network and how it changes over time
Assumed relationship between science and values	Science is inherently value-neutral (though research can be used for benign or malevolent motives)	Science can never be value-neutral; the researcher's perspective must be made explicit	Facts are interpreted and used by people who bring particular values and views	Science must be understood in terms of what gave rise to it and the interests it serves	Controversial; arguably, Actor-Network Theory is consistent with value-laden view of science
Assumed mechanism through which impact is achieved	Direct (new knowledge will influence practice and policy if the principles and methods of implementation science are followed)	Mainly indirect (e.g. via interaction/ enlightenment of policymakers and influencing the 'mindlines' of researchers)	Interaction between reasoning (of policy makers, practitioners, etc.) and resources available for implementing findings	Development is critical consciousness; partnership-building; lobbying; advocacy	'Translations' (stable changes in the actor network), achieved by actors who mobilise other actors into new configurations
Implication for the study of research impact	'Logic models' will track how research findings (transferable research findings about what works) are disseminated, taken up and used for societal benefit	Outcomes of social interventions are unpredictable, impact studies should focus on 'activities and interactions' to build relations with policymakers	Impact studies should address variability in uptake and use of research by exploring context-mechanism-outcome-impact configuration	Impact has a political dimension; research may challenge the status quo; some stakeholders stand to lose power, whereas others may gain	For research to have an impact, a re-alignment of actors (human/ technological) is needed; focus on the changing 'actor-scenario and how this gets stabilised in the network

Table A.1: Philosophical Assumption (Greenhalgh et al. 2016, 3)

Types of evaluation	Examples of methods/approaches	Use	Types of impact typically evaluated
Experimental and statistical methods	Statistical modelling, longitudinal analysis, econometrics, difference-in-difference method, double difference method, propensity score matching, instrumental variable, analysis of distributional effects, experimental economics	Typically used in summative mode, ex ante and/or ex post, to infer the extent to which research is a sufficient cause of impact (often showing sole and/or direct attribution from research to impact)	Economic, environmental, social, health and wellbeing, policy, other forms of decision-making and behaviour change
Systems analysis methods	Contribution analysis, knowledge mapping, Social Network Analysis, Bayesian networks, agent-based models, Dynamic-System Models, influence diagrams, Participatory Systems Mapping	Can be used in formative or summative mode, usually ex-post or during a pathway to impact	Policy, other forms of decision making and behaviour change, capacity building
Textual, oral and arts-based methods	Testimonials, ethnography, participant observation, qualitative comparative analysis, linkanges and exchange model, interviews and focus groups, opinion polls and surveys, other textual analysis, e.g. of focus groups and interview data, participatory monitoring and evaluation, empowerment evaluation, action research and associated methods, aesthetics, oral history, storytelling, digital cultural mapping, (social) media analysis, poetry and fiction, music and dance, theater	used either in formative mode to enable beneficiaries to engage and shape feedback that then enhances impact, or in summative more, ex-post to access the extent to which research contributed to impact	All types
Indicator-based approaches	Theory of Change, Logical Framework Analysis, Payback Framework, SIAMPI, DPSIR	Indicators-based approaches use indicators to assess progress towards anticipated impact. Any method may then be used evaluate each indicator. These frameworks can be used in summative or formative mode, typically ex-ante(but can be used ex-post) to show the extent to which research contributes towards, or was a necessary cause of, impact	All types
Evidence synthesis approaches	Meta-analysis, narrative synthesis, realistic-based synthesis, rapid evidence synthesis, systematic reviews	Used in summative mode, e-post, to infer sole attribution of quantify the extent to which research was a sufficient cause of impact	All types

Table A.2: Types of Research Impact Evaluations and Their Commonly Used Methods/Approaches (Reed et al. 2021, 5)

Tool	Summary
Interview	Interviews are a valuable tool for exploring the conditions that contribute to impactful outcomes. They offer a chance for informants to share insights, allowing interviewers to tailor questions based on responses. Structured interview guides aid in cross-case comparisons and can reveal motivations, enablers, or concerns related to impact creation. While qualitative interviews can be used at various stages of a research project, there are challenges such as informants lacking perfect information, timing affecting reliability, and the potential for overemphasizing non-research impacts. Training interviewers and addressing issues in data transcription and analysis are also important considerations.
Case study (narrative Approaches)	Case studies offer a nuanced exploration of complex scenarios, detailing specific pathways leading to the real-world use, uptake, and impact of research. Particularly favored in social sciences and humanities literature, they encompass a broad range of impact areas like policy, health, business, and culture, often overlooked by data-driven approaches. Despite their strengths in providing coherent narratives, case studies face criticism for their subjective nature, making comparison and ranking challenging. Additionally, they tend to prioritize recent research, potentially neglecting long-term impacts, and may struggle to provide clear evidence for all types of research. Critics argue that the method's focus on tangible impacts may idealize outcomes, overlooking barriers and negative effects. Moreover, the labor-intensive nature of case studies poses challenges for both researchers and assessors.
Surveys	Surveys are effective for collecting data on various variables such as motivations, barriers, enablers, and different types of engagements between researchers and society. They enable comparative analysis of performance over time and throughout the research process. However, surveys have limitations. They primarily rely on self-reported evidence, potentially biased towards mapping involvement rather than observing real-world effects. Surveys assume quantitative measurement of research impact, but the validity of indicators like dissemination efforts and relationships with policymakers is contestable. Direct relationships between research and policy change may be scarce, requiring validation through additional methods like qualitative interviews. Surveys may not adequately capture unforeseen impacts and context-specific factors. Consequently, they often necessitate supplementary methods for validation and may be less responsive to unexpected influences.
Peer/expert review	Peer review, encompassing expertise-based assessments in various contexts like journal manuscripts, funding applications, and hiring, is mentioned in 36% of our review texts. Regarded as a crucial method for quality assessment across scientific domains, it involves experts evaluating quality within the field or external indicators. Quality indicators include output measures and indicators of reputation. Used in assessments of scientific excellence and societal impact, peer review is flexible and highly trusted. It can be implemented at different research stages, aiding in understanding societal impact, allocation of funding, and mid-term/final evaluations. Despite its widespread use, peer review faces criticism for potentially delivering an 'acceptance threshold' rather than measuring impact. Bias towards renowned scholars may lead to positive judgments and funding, creating a "Matthew effect." The method is also criticized for being time-consuming, impractical due to the number of involved experts, and requiring well-informed individuals with in-depth knowledge of the research context.
Statistical databases	Statistical databases are valuable for describing research infrastructures, facilities, income, scientific degrees, and prices across various scientific fields. They enable tracking developments over time and between research units, facilitating data combination for comparative analysis. However, literature points out drawbacks, such as hindrances due to administration and user rights, requiring repetitive agreements for joint dataset utilization. Maintenance, documentation, and validation of registries may pose challenges. Administrative and statistical databases alone may struggle to document and derive impact from specific projects, particularly informal engagement efforts. Nevertheless, some contributions highlight the utility of statistical databases in national evaluation systems, emphasizing the importance of considering the relationship between disciplines, the academic environment, and academic and societal outputs.

Tool	Summary
Commercialization data	Commercialization data, often used alongside bibliometrics, is part of a quantitative assessment approach, particularly focused on economic effects related to technology transfer and the business sector. Indicators like patents, licenses, joint research, and industry funding are commonly used. While this method can identify formal relationships between researchers and society, it faces challenges in comparing commercial impacts across disciplines and contexts. In the social sciences and humanities (SSH), where impact is established through non-economic channels like policy reports and public lectures, the economic transaction model is considered insufficient. Critics argue that a narrow focus on commercial impact neglects the broader socio-technical system and the entanglement of economic and non-economic factors in creating impact. Research on topics like sustainable infrastructures or intercultural understanding, while impactful, may not be accurately reflected through standard economic indicators.
Bibliometrics	Bibliometric methods primarily focus on assessing the academic impact of research through publications, citations, and authorships, rather than societal impact, the main focus of our review. While bibliometrics offer objective statistical tools for evaluating scientific performance, especially in life and natural sciences, they face criticism in the social sciences and humanities (SSH). SSH scholars argue that bibliometrics, historically developed for other disciplines, inadequately capture SSH's non-journal publications, non-English language works, and field-specific notions of 'quality.' Responses to this criticism range from improving metrics for SSH to questioning the use of metrics across research fields. Despite their limitations, bibliometrics are considered useful when applied responsibly, but in the context of SSH, they cover only a fraction of researchers' communication and lack evidence of broader societal engagement. Relying solely on bibliometrics for evaluation is criticized for distorting the view of scientific outputs and overlooking research's broader societal relevance. In impact assessment frameworks reviewed, bibliometrics are exclusively used for academic impact assessment, while other methods like altmetrics are employed to capture evidence of broader societal uptake of research. Onderkant formulier
Impact plans theory of change and logic models	Impact plans play a dual role, either retrospectively describing the context, activities, and outputs of research that influenced society or prospectively outlining how a project aims to achieve desired results. In the Research Excellence Framework (REF), impact plans are used to provide context and evidence for individual case studies, accommodating particular circumstances. Frameworks like ROMA and RCF utilize impact plans in the preparation phase based on a 'theory of change,' guiding project stakeholders and allowing for examination of factors influencing research uptake throughout the project's lifecycle. The 'theory of change' approach, while challenging for highly innovative projects, fosters an open-minded and iterative research process. It requires an explicit understanding of the research mission, external actors' interests, and specific activities linking research to society. Some impact assessment models combine logic models with impact plans, templates, and case studies, aiming to capture the intricate processes and interactions in knowledge production, uptake, and use in society. Logic models help track specific outcomes and break down different types of research-associated outcomes, emphasizing the need for sensitivity towards indirect impacts and links between research and society.
Workshops and focus groups	Workshops and focus groups are organized discussions involving researchers, partners, and stakeholders held at various assessment and research phases. They can be used early on to co-produce ideas, set objectives, and accelerate research impact by mobilizing attention. These methods facilitate collaboration, development of dissemination strategies, and exploration of impact evidence sources. Cost-effective and influential, workshops and focus groups are also employed post-project to capture immediate effects on partner institutions or target groups. However, literature notes risks, including participants potentially downplaying negative impacts and having selective memory, emphasizing positive outcomes.

Tool	Summary
Stakeholder/user evaluation	Stakeholder evaluation involves stakeholders as partners in the research project, collaborating in knowledge co-production and influencing the project's organization, implementation, and assessment. This approach may lead to the co-production of evaluative indicators and broader participation in the research process. Stakeholders serve as valuable informants, offering insight into partner organizations and improving awareness, understanding, and communication between researchers and stakeholders. Involvement of stakeholders can occur in the design phase to align research with specific needs, breaking down barriers and cultural differences. It may also happen during the research process to gather information on preliminary benefits. However, there is a risk of compromising research integrity and academic freedom if partners become overly involved. Stakeholder involvement in indicator evaluation or design is less common, but some frameworks use it to develop shared understanding and guidelines (RAPID) or involve potential end-users throughout the research process (CM). Stakeholder information gathering is common in the literature, though it can be time-consuming, and aligning indicators with stakeholders is not prevalent in all frameworks.
Impact repositories	Impact repositories and databases are integral to the Open Science agenda, promoting collaboration and knowledge sharing in academic and policy spheres. Notably used in the policy literature, initiatives like OpenAIRE and CORDIS support impact measurement, providing data for Horizon2020 projects and serving as a primary repository for EU-funded research information. REF employs an impact database listing submitted case studies, while AHRC builds a portfolio of impact case studies. Databases enable the location of individuals linked to specific research projects and facilitate broader dissemination of research results. They allow for explorative studies of impact data, providing nuanced representations across fields. Despite their advantages, repositories require researchers to invest time in documenting impacts and face ethical considerations related to data sharing and security. Impact assessment frameworks emphasize the importance of impact repositories for broader communication and dissemination, promoting wider interest in research and making data accessible to a broader audience of practitioners.
Altmetrics	Alternative metrics (altmetrics) are gaining attention in assessing scientific impact, particularly in the social sciences and humanities (SSH), where diverse outputs beyond traditional publications are common. Altmetrics track research communication and sharing on platforms like Twitter now X, Facebook, blogs, and digital sharing services, offering a broader perspective. Recent improvements include integrating non-traditional outputs like policy reports or white papers. Altmetrics collect various data types, such as citations, views, downloads, tweets, shares, likes, and comments, providing big data to quantify dissemination efforts and digital scholarly conversations. Altmetrics are advantageous for tracking broader societal outputs, including media presence and attention, serving as supplements to case studies and narratives. However, limitations include difficulty in comparing data across disciplines, bias towards specific users, and uncertainties in interpreting mentions or downloads. Altmetrics require a reflexive and responsible approach, recognizing it as a supplementary rather than universal method for assessing societal impact.
Impact Tracking and activity registration	Process-tracking is a technique for tracing impact pathways either forward from initial research or backward from identified outcomes. Backward-tracking, used by HERG, traces return on investment, uncovering how and why specific outcomes or impacts succeed. It allows measurement against goals set by research institutions but relies on the quality and accessibility of relevant documentation, facing difficulties in attributing outcomes to specific research results. Forward-tracking, employed by SIAMPI and RCF, identifies links and interactions leading to socially relevant applications. SIAMPI emphasizes analysing processes to recognize potential impacts, while RCF uses a theory of change to track relations and pathways. Forward-tracking connects research objectives, processes, outputs, and outcomes, identifying barriers and enablers of impact. Process-tracking utilizes both qualitative (interviews, impact logs) and quantitative approaches (social network analysis, geo-referencing). However, systematically describing ways to achieve impact during or after a project is challenging, with studies finding a lack of systematic data hindering information on productive interactions. Researchers often claim importance for specific interactions without independent data for assessment.

Tool	Summary
Review and analysis of documents	Document analysis involves reviewing and interpreting existing documents like books, policy reports, white papers, and grey literature. This method can be used qualitatively and quantitatively, often combined with computational text analysis or traditional coding strategies. It aids in understanding the content and context of specific outputs but heavily relies on the quality and systematic collection of existing materials, providing limited insights into non-written research outputs. While no single method is universally applicable, various methodological strategies may be needed, complicating study design and requiring extensive expertise and time for adaptation.
Field/site visits	Field visits are utilized in the Netherlands' national evaluation system to assess research at universities and research institutions. The method aims to showcase the quality and societal relevance of research. During field visits, evaluators observe research on-site, engaging with principal investigators and staff to gather insights into their experiences, plans, and strategies. While valuable, the reliability of qualitative data from field visits can vary, presenting challenges similar to other qualitative measures like workshops and interviews.

Table A.3: Tools for Research Impact Evaluation (Budtz Pedersen et al. 2020, 9-14)

Category	Tool	Use
Formative, flexible and able to deal with cross-disciplinary and multidisciplinary assessments	Case studies	Can be used in a variety of ways; flexible enough to capture a wide variety of impacts, including the unexpected, and can provide the full context around a piece of research, researcher or impact.
	Document review	Review of existing documentation and reports on a topic.
	Site visits	Visit by evaluation committee to department and institution; generally consists of a series of meetings over one or more days with a range of stakeholders.
	Peer review	Review by peers, typically other academics in the same or similar field, of outputs of research; rationale that subject experts are uniquely qualified to assess the quality of the work of others.
	Interviews	Used to obtain supplemental information on areas of interest, generally to access personal perspectives on a topic, or more detailed contextual information.
Scalable, quantitative, transparent, comparable, free from judgement and suitable for high frequency, longitudinal use	Bibliometrics	A range of techniques for assessing quantity, dissemination and content of publications and patents; uses quantitative analysis to measure patterns of publications and citation, typically focusing on journal papers; Offers insights principally along the following dimensions: activity measurements, knowledge transfer measurements, linkage measurements, citation analysis.
	Survey	Provide a broad overview of the current status of a particular programme or body of research; widely used in research evaluation to provide comparable data across a range of researchers and/or grants which are easy to analyse
	Economic analysis	Comparative analysis of costs (inputs) and consequences (outputs);aims to assess whether benefits outweigh opportunity costs and whether efficiency is achieved; generally, there are three types of economic analysis: cost-benefit analysis (CBA), cost-effectiveness analysis (CEA) and cost-utility analysis (CUA).
	Data mining	Allows access to and understanding of existing data sets; uses algorithms to find correlations and patterns and present them in a meaningful format, reducing complexity without losing information.
	Data visualisation	Tool for data summarisation, presenting large amounts of data in a visual format for human comprehension and interpretation.
	Logic models	Graphic representation of the essential elements of a programme or process; aims to encourage systematic thinking and guide planning, monitoring and evaluation.

Table A.4: Tools for Research Evaluation (Guthrie et al. 2013, 9)

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