E*x ante* evaluation of societal impact in research: towards a conceptually-based reflection

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Abstract

The idea of creating societal impact from publicly funded research has grown in the last decade from a relatively fringe concern related to high-technology entrepreneurship and spin-off companies to an increasingly dominant element of public policy demands for research. This has in turn stimulated a growth in academic science policy research looking at research impact and seeking to conceptualise the ways in which knowledge creation in academic contexts can be coupled to real world outcomes. The bulk of this research has focused on ex post impact, the impacts created by individual research activities or streams after their completion, and there has been much research on ex post impact evaluation. However, evaluating impact *ex ante* – in research proposals – is becoming increasingly important to funding decisions, and there is very little knowledge relating to what constitutes good impact in a planning proposal. Achieving effect *ex ante* impact evaluation is necessary to ensure that resources flow to researchers who are planning to create impactful research, and thereby encouraging all researchers to deliver impactful research. In this paper, we develop a conceptual framework for evaluating research impact *ex ante*, noting that a research proposal constitutes a promise to create future impact. We argue there are two dimensions by which proposals make credible promises, by proposing activities that couple their knowledge with users, and also by making those coupling elements dependencies within the overall project proposal. On this basis, we propose an overall conceptual framework for evaluating research proposal impact *ex ante*, and suggest an analytic framework for exploring this empirically.

Keywords: research evaluation, research impact, societal impact, knowledge exchange, science policy.

JEL Codes: I23 Research Institutions; O32 Management of Technology and Innovation; O38 Innovation Policy .

1. Introduction

The framing for this piece is Donovan's (2017) perspective on the science of research impact evaluation, and particularly, the sense that there has been a huge amount of policy that has been formulated. This has the overall effect that science policy researchers are profoundly framed in what they look at by policy-makers' (sometimes quite opportunistic) prior decisions (Donovan, 2019). There has been much consideration of the notion of *ex post* impact evaluation as Donovan (2019) notes in response to policy pressures to measure impact. However, there has to date been little consideration of the theoretical foundations of *ex ante* evaluation of impact, something that is becoming increasingly important to policy-makers. We see for example in the UK that applications to the national Research Councils have for 15 years required statements to be made regarding anticipated impact, and their 'pathways to impact' are an important element of the funding decision. Likewise, in Norway, *Forskningsrådet* have in 2019 for the first time introduced an impact section in their research funding applications. In the Netherlands, a 2019 survey of 2000 research council funding applicants found that these applicants felt that social impact should account for around 20% of the evaluation of a research proposal (NWO, 2019)The issue of *ex ante* impact evaluation has tended to be treated predominantly descriptively (Holbrook & Frodeman, 2011), suggesting that the task of developing the theoretical micro-foundations of *ex ante* impact evaluation is increasingly urgent. In this paper, we therefore seek to reflect on the role that *ex ante* impact plays in research proposals and therefore how it could be evaluated in ways that allow the evaluations to make a serious distinction between proposals with a higher or lower impact potential.

To do this, we contend that the role of *ex ante* evaluation of research proposals is as a form of academic steering, although the precise effect that the steering produces is not always that which is anticipated in advance by those setting the rules of evaluation (Reale & Zinelli, 2017). Although *ex ante* evaluation was been dismissed by Ziman (1983) (cited in Rip, 2000) as making a judgement about discovery based on personal intuition, it remains a highly popular response by research funders for taking funding decisions (König, 2015). In Rip's model (2000), *ex ante* evaluation forms an aggregation machine in which researchers make proposals that are sifted and sorted through a set of procedures to take decisions that allocate funding. In this paper, we consider the steering effects on how scientists prepare their proposals in order to best position their individual proposal vis-à-vis these rules. We conceptualise *ex ante* evaluation as exerting an *ex ante* steering effect on researchers; before proposals are even submitted, and via these steering

effects on those that submit but are not funded[1], this *ex ante* evaluation can have a more general steering effect on the system.

An additional element of Ziman's conundrum is that even if norms and practices can emerge to allow sensible *ex ante* decisions to be made about scientific quality in proposals, societal impact is a much more recent field, characterised by a diversity of channels, pathways, practices and contributions (Muhonen *et al.*, 2019). As a result of this, there is not sufficient agreement or consensus amongst scientists about what can constitute valid and legitimate impact in the context of this sifting and sorting process (Bozeman & Boardman, 2009). Creating a valid theoretical framework for steering of societal impact by *ex ante* evaluation of research proposals also requires creating a framework for understanding how impact is created as well as understanding how that can be encoded in proposals. The basis for our argument is that proposals function through their internal coherence, and therefore claims that are made in the proposal can have a binding effect on what will subsequently be delivered. We therefore ask the specific question of what are the conditions under which a research proposal can create dependencies and binding commitments that increase the propensity of that research to create impact?

To do that, we look at this issue of the propensity of research to create societal impact and draw on a framework developed elsewhere, that of openness, which notes that the incorporation of societal knowledge in various forms of research processes increases the cognateness of the produced knowledge (*ceteris paribus*) to societal users. In this framework, openness (propensity of knowledge to lead to impact) involves researchers incorporating external knowledge in five kinds of research micro-practices (inspiration, planning, execution, dissemination and framing). The second step in the argument conceptualises the way that *ex ante* evaluation functions as a steering mechanism, which we conceptualise in terms of mid-level scientific theory where scientists seek to access resources from funders and therefore attune their requests to funders demands; one way to signal the usability of research to funders is therefore to produce proposals that plan to make use of these open research practices. We consider the legitimacy and norms issue by considering the ways that proposals make binding commitments by coupling themselves to resource bases and constitute consistent pathways demonstrating how a chosen set of research activities create knowledge that will address an identified research gap. On this basis we identify various kinds of open research practice that could potentially be incorporated into research

[1] More generally we anticipate there are steering effects on those that materially engage with the proposal writing process, in devising research plans that include an impact creation element, in which they may reflect on impact, talk about impact, solicit partners for impact and undertake other activities that become part of their research repertoire.

proposals in a consistent that demonstrate coupling to societal knowledges that in turn creates confidence that they can contribute to creating societal impact.

2. Excellence and the societal impact of research

Evaluating societal impact of research is made complex by four characteristics of societal impact, of which we highlight two here (Bornmann, 2012). The first of those is that what it actually represents is extremely diverse both within disciplinary fields but also between different fields (Watermeyer, 2014). Secondly concern with creating societal impact as an *academic* activity is relatively novel and is often constructed as being outside of rigorous academic practice, which means that academic disciplines do not develop norms and standards of what represents legitimate, quality activity in impact creation (Holbrook & Frodeman, 2011). Bozeman & Boardman (2009) critique a notion of research impact that assumes that research impact is created by those researchers that create the knowledge (what Martin, 2011 refers to as the attribution problem). Knowledge that creates impact will draw on a range of antecedent knowledges, making the critical characteristic for antecedent knowledge the ease with which it can become attached to an act of impact creation (Benneworth & Olmos Peñuela, 2018). The key issue in impactful research lies not in the act of impact creation being carried out by the researcher, but that the knowledge is used by someone in act of impact creation, suggesting the need to look at what determines how research can be used by others.

2.1. Beyond a linear model of impact creation: building the reservoir

The starting point for our idea is the contention that research – knowledge creation – is an accretive process in which knowledge builds up over time (Santos, 1989) although not necessarily in a linear way. Research creates new knowledge and adds it to what Hess & Ostrom (2007) term the "knowledge commons", taking as its starting point existing knowledge, then by testing that knowledge, extending or challenging the existing knowledge. The flow of knowledge from individual acts of research to the collective knowledge commons takes place through peer validation processes which affirm that the newly created knowledge is of sufficient quality to be added to the knowledge commons. Hess & Ostrom indicate the role that publications channels play in supporting this knowledge commons, both in terms of making information accessing but also in terms of providing an imprimatur of quality. The societal impact of research therefore emerges through accretive chains in which individual research acts enable new research acts, and then eventually that knowledge feeds forward into a final act of knowledge creation (Benneworth & Olmos Peñuela, 2018).

The value of research in terms of creating scientific impact can be understood as the capacity of a piece of knowledge creation to serve as the basis for future knowledge creation, an understanding which has been formally codified into the field of bibliometrics as the measurement of citations as proxies for the foundation one contribution creates for a field (Hicks, 2017; Petersohn & Heinze, 2017). Scientific impact emerges when a final user is able to acquire the knowledge, it can understand the knowledge, and it can apply the knowledge in its own knowledge processes such as innovation activities (Zahra & George, 2002). We contend that acquisition of published academic knowledge is relatively trivial, and application is an emergent characteristic, revealed through the act of use. The one critical factor which an academic can influence is the ease with which a user can understand and absorb that knowledge (Cohen & Levinthal, 1990).

We conceptualise that ease of use in terms of the **usability** of research; this is a latent characteristic that is separated from the eventual use of that knowledge. Researchers make that knowledge accessible to potential users, and then their job is effectively completed (as long as the users can physically access the knowledge). Part of that acquisition depends on the capacity of users, and this is something that researchers in general cannot easily affect. But we here draw on Camison & Fores's (2010) definition, and note that "a common language" [between researcher and user] (p. 708) *is* something that researchers can influence: it takes two sides to have a common language. We here take a common language not to refer to the vernacular language spoken but rather about talking *about* the same things in the same way. We take this in turn to mean that the researcher and the user are part of what we might metaphorically think of as the same conversation around the object of research, and that the direction and turn of the conversation have been sufficiently interesting to the user to still have value for them. This is a situation which Kitcher (2001) described as "well-ordered science" in which determinants over the choice of questions for study and approaches to use are not unilaterally shaped by researchers, but through communities in which societal users participate and can give signals which shape the overall direction of travel[2].

2.2. Scientists maximising contributions by attuning with scientific goodness signals

In this working paper we adopt a mid-level theory of science concerned with the question of what the scientist has to do to be able to prosecute science (Glaser, 2012), and a key issue here is that of scientific credibility. Credibility emerges in scientific systems (Latour & Woolgar, 1979)

[2] It is important to stress the *governance* scale of the argument being made here; this is not equivalent to saying that a single user gets to shape what a single researcher does, rather that what the community does as a whole is shaped in aggregate by a series of quality signals that reward good research and hinder bad research. Users also give signals, based on their own criteria, and just as a single researcher cannot determine what a field as a whole does, nor can a single user.

with at the centre of those scientists seeking to access the resources necessary to carry out science (Hessels & Van Lente, 2011). Hessels & Van Lente, explicitly following Latour & Woolgar, highlight six forms of resource that play a role in this calculus, namely money, staff/ equipment, data, arguments, articles and recognition. Winning resources helps to gather data, data enables the production of arguments, arguments facilitate articles, and articles can lead to the award of more resources. This cyclical nature, and the fact that the possession of one helps with the pursuit of others: the most credible scientists find it easier at the margins to attract these resources, producing the well-recognised Matthew effect ("to he who hath shall be given", Merton 1968). This is not always entirely desirable and can lead to a distortion of priorities (Jones & Wilsdon, 2018)

From this perspective, scientists can be understood as preparing their research plans and attuning their ongoing activities to ensure that they maximise their responsiveness to these signals; these activities represent a space of governance in which the directions of individual research activities change. Because these anticipation and attuning practices relate to wider communities of likeminded researchers, they have an aggregate effect of shaping scientific progress towards what are agreed to be 'better' outcomes in the scientific communities concerned. Kitcher identified three kinds of decision-making practice which represent micro-spaces of science governance, and Olmos Peñuela *et al.* (2019) expand this to include five kinds of practice where researchers anticipate, attune and react to signals from elsewhere in the scientific community.

- **Framing**: researchers decide what is of interest to them and what not in general terms; on this basis, academics form themselves into communities in various ways, including epistemic communities with epistemic cultures that are the loci within which these discussions take place and which define what should or should not be talked about (Knorr-Cetina, 1999).
- **Inspiration**: a researcher decides to work on a specific topic within their particular chosen framing, and devises a research question that identifies the potential conceptual space within which a contribution might be made (Ziman, 1981). A researcher typically uses a literature review process to construct a specific framing of a particular problem as being scientifically interesting by responding to a knowledge gap, and may attune that with the community in informal ways through participating in seminars and other kinds of communications.
- **Planning**: a researcher seeks to write a convincing proposal that will be judged as being good; activities are listed that will deliver the goodness; good proposals are those that show that they have been planned with reference to the norms prevailing in the community where the project seeks to contribute (Ziman, 1981).

- **Execution**: researchers seek ongoing feedback to attune their knowledge creation activities to increase its eventual uptake: more traditionally, attending conferences, having international advisory panels/ boards, organising scientific workshops, and issuing working papers are ways in which researchers. More recently, social media has also started to play a feedback role, from blogging to pre-submission preprints.
- **Dissemination**: placing findings in the public domain to maximise audience uptake, through journal articles, books and outlets, as well as organising public engagement and user dissemination seminars and events, and creating user-targeted outputs such as briefs, videos, summaries.

These five processes provide a mechanism for understanding the key governance arenas where scientists are steered by their communities, by taking into account external signals and considerations in taking those decisions. Scientists seek to optimise their research to be as good as possible by attuning themselves in various ways with the expectations of their overall community (Ziman, 1981). The attuning function operates when scientists receive signals about what constitutes good behaviour from their wider community, interpret that as to what it could mean for their own practice, and then apply it in their own practices (which we conceptualise in terms of the five practices above). They do this in the hope that their research decisions will lead to outputs that are judged by the community as being better – facing a set of choices in a research practice, a scientist uses community signals to inform the choice of which of those choices will lead to a better outcome in the sense of creating something that better fits into the field. When user signals are included in those considerations, and when user voices are heard in the communities in which researchers are active, then those outcomes will be better for the users, and extending Camison & Fores (2010)' definition, they will be in a language the user comprehends. Olmos Peñuela *et al.* (2015) define researcher practices where researchers take into account user as well as scientific considerations as being 'open' – by being open to user as well as scientific considerations, they frame their research activities in a language that users speak, thereby increasing the later usability of that knowledge (it is more absorbable by users, in Zahra & George's framework).

2.3. Attuning to societal as well as scientific signals: the openness mode

In 2.2, the idea of signalling processes is used as a catch-all to refer to the ways in which scientists attune their behaviour in response to the community. The signalling process is on of validation within a knowledge community; the community's past activities give a signal of what constitutes goodness, even where that is not formally codified, and the scientist then ensures that their

activities demonstrate that they meet those levels of 'goodness'. Science is a knowledge process and scientists use scientific knowledge in various way; what constitutes good methodology in a plan, a good research question addressing a gap, a robust analysis, is all defined by what others have already done. And those achievements, the shared knowledge of the community, are often represented but not exclusively so by research outputs[3]. Scientists use that knowledge meaningfully – it is not enough to simply cite a source or use a phrase, but the way that a concept is used has to be logically consistent with wider theoretical framework to avoid producing conceptual chaos and thin concept borrowing (Markusen, 1999; Lagendijk, 2003; Benneworth & Henry, 2003).

That process of demonstration in turn steers the activity towards what the community considers good (and if successfully completed, itself becomes a consideration and signal of goodness within that community). This is what leads to the coherence of diverse scientists operating without mutual personal knowledge into a community; through these micro-practices, scientists couple themselves to a particular scientific community. Through that coupling they effectively becoming a voice that can represent a signal of goodness in that community, and ensure that their research activities ultimately with the aim of making the best contributions to the scientific community. We therefore argue by a process of comparability that implicit within the openness model is the notion that open micro-practices serve to couple research activities to societal users, so that they eventually make the best societal contribution possible[4]. And just as scientific coupling takes place through the use of scientific knowledge in various research micro-practices, this societal coupling also involves the use of societal knowledge through these five micro-practices. It is not just that the use of knowledge leads to researchers and users speaking the same language, rather that there is a steering effect that draws and holds them together, and makes the research more acquirable by users (following Zahra & George, 2002).

Just as scientific coupling involves a consistency criterion, that the knowledge must be used in ways that are consistent with the wider frameworks within which it operates, we contend that the societal knowledge must also be used in a consistent way within the process. For the societal knowledge to be used in a consistent way, it is something exogenous simply referred to or cited

[3] That is why people who are doing case study qualitative research often make use of Yin (2003) in various ways; it embodies knowledge about how to do good qualitative research, and the fact that it is so highly cited, with 175,000 Google Scholar citations at the time of writing, means that it exerts a steering effect.

[4] It is important to emphasise here that the best does not mean that it is the sole concern of the research. Most research is incremental and leads to relatively limited scientific impact, in terms of cites and further research ideas, and that can be good enough. Likewise, the best societal impact here means that the best societal impact that can be achieved in the scope of the knowledge activity with an existing focus, not that Dark Age historians are, in the view of Collini (2010) being pushed to write Alfred the Great cookbooks.

but that it is incorporated into the research practice in ways that make a difference to had it not been incorporated. Through that incorporation there is a coupling of the resultant knowledge to societal interests, and that has an overall effect of making it more acquirable by societal users: the knowledge produced is more *usable*. These coupling processes operate through the five processes previously distinguished, as indicated below (Julia Olmos Peñuela *et al.* 2015, Benneworth & Olmos Peñuela, 2018).

- **Framing**: through the characteristic of research being path-impregnated (Knorr-Cetina, 1981), researchers are framed at critical moments in their research careers, through by being involved in research activities where working with societal partners is seen as being a valid part of undertaking good research (leading them to have a more Pasteur than Bohr identity, in the language of Stokes, 1997)
- **Inspiration**: a researcher being receptive to external knowledge regarding the nature of problems and including that in the consideration or the formulation of that project; it is not just that a phenomenon is interesting but that a societal partner also signals that problem to be interesting, and that societal signal plays a material role in the way that the research question is formulated.
- **Planning**: involving societal partners meaningfully in planning, allowing societal partners to provide input and feedback that shapes direction of the project in ways that align the scientific and the societal interests in a plausible plan (the pro-social practices of d'Este *et al.*, 2016).
- **Execution**: the use of external knowledge in ways that augment and extend research trajectories, such as by making facilities available, providing complementary or specialist knowledge to provide additional insights, by providing feedback and reflection on interim results, and even training research staff to carry out particular tasks.
- **Dissemination**: making research available in ways that enables user feedback that in turn constitutes a future knowledge resource, interactive dissemination as a dialogue users regarding the relevance and applicability of the created knowledge, and seeking to place the knowledge in outlets outside the academic sphere (Zahra & George's access function) in which fitting with non-academic editorial needs steers reflections on what makes the research societally interesting.

We have previously referred to the idea of these signals as steering towards good science. Following Kitcher's notion of well-ordered science, we denote those signals that come from societal and scientific peers within a community as being well-ordered signals, to denote that

those signals come from within the field and are concomitant with 'good' science without there necessarily being a contradiction between scientific excellence and societal relevance.

3. The role of evaluation in scientific governance

In section 2 we have set out our mid-level theory for understanding scientific behaviours as a response of a set of signals from communities with which a scientist identifies, as a process of attuning which couples these communities togethers and ensures that science delivers what is deemed to be good for community members. There are many kinds of signals that scientists give to each other in their scientific communities, including through face-to-face interaction, feedback, and research exchanges. One of the most important signalling mechanisms in contemporary science is "evaluation" in which a scientist proposes something, a project, some research findings or a research output (in the language of Latour & Woolgar, a scientific conversion), and that is evaluated by a third party. Evaluation processes work because scientists modify their behaviours in various ways, although we note that not all scientific evaluation is about evaluating the scientific goodness of something proposed (Molas Gallart, 2015), and may relate to legitimating resource distribution or around other definitions of what constitutes goodness outside these scientific communities (in Kitcher's sense also encompassing well-ordered societal users). Nevertheless, evaluation plays an important steering role and in this section we consider the roles that research evaluation plays under conditions when it is seeking to steer towards well-functioning scientific communities.

3.1. The function of evaluation in regulating academic credibility cycles

In this paper we foreground the role of evaluation as playing a gatekeeping role in this cycle of credibility by determining this progression within the cycle. Progression through the cycle -what Woolgar & Latour call the *conversion* between the different forms of capital -is regulated in decision-making forums, that constitute scientific governance. These forums relate to the communities within which scholars operate – scholars seek credibility in particular fields in which resources lie and therefore subject themselves to the regulation by the decision-makers in those fields. Those fields are only partly fungible, for example, as data gathered in one field may be unconvincing for securing credibility in another field. We contend that evaluation represents a key mechanism within this scientific conversion process, in determining whether a scientist is permitted to make a proposed conversion; this takes place around decisions around which projects get funded, which papers are published, which researchers get access to structural support via tenure or promotion (Zimmerman & Merton, 1971). By 'conversion' we mean a progression from one stage to the next of the credibility cycle. By way of example, a scientist may

have developed arguments, and wish to turn them into an article; the scientist writes up a paper and submits it to one forum; the regulatory framework decides whether this is successful, whether the arguments are converted into an article (or not).

But the scientist is not the only party with agency in these decision-making arenas, as these evaluations are made by other members of these well-functioning science communities, when there is peer evaluation. Zimmerman & Merton (1971) observed that evaluators participating in these decisions operated with a desire to take 'good' decisions in the knowledge that they could be open to later scrutiny. Miller (2006) refers to "paradigm development"[5] as a state existing within a field where there is regarding what constitutes good research guiding these evaluative decisions. But this is not purely on the basis of existing norms; the introduction of new criteria into evaluation leads evaluators to try to make sense of those evaluators in a reasonable way that would be accepted as being legitimate within their paradigm in Miller's sense (Watermeyer, 2019). The way that this works is through the emergence of shared understandings of what constitutes goodness in these communities, in taking allocative decisions in ways that have an internal consistency thereby maximising the contribution to the health of the field (Moxham & Fyfe, 2018).

3.2. Evaluation as well ordered signals within scientific governance processes.

The first order impact of evaluations is straightforward, in that they regulate these conversion processes after they have been initiated by a scientist (when a proposal or paper is for example submitted). But as Zimmerman & Merton (1971) observe, the effects of evaluation are not only at the point of the decision to be made about the proposed conversion, when the evaluation takes place. Those proposing the activities take into account the ways that they expected the evaluators to take their decisions in terms of the norms prevailing amongst those communities, and prepare their proposed activities more "carefully, in the knowledge that they would be scrutinised" (Zimmerman & Merton, 1971, p. 73). Sometimes the evaluations take place against predetermined rules and criteria, and evaluators have the role to determine whether a proposed conversion fulfils these criteria. Those proposing conversions seek to anticipate how they will be evaluated, based on formal criteria, but also based on other signals they have had from the field about what constitutes 'good' research so that they conform more generally even where there are not specific criteria.

[5] If we are looking to make a specific SSH argument here then one of the reasons that research evaluation in the SSH is so interesting is that it is a relatively underdeveloped paradigm for evaluation, in that there are really divergent views of what constitutes 'good' research, and therefore there is a lot of interpretation of what it means t be good with the risks that it is not well-ordered in terms of permitting productive progression.

There are other ways in which scientists receive signals from evaluations that they take into account in their preparatory activities, either shaping their general understandings of what it means to do good research or the specific criteria they must fulfil. Firstly, scientists have received signals in the past from evaluations of their past research activities that provide direct feedback upon the ways in which different communities respond to their activities. Part of Knorr-Cetina's path impregnation (1981) process comes through scientists being drawn towards situations where their ways of working tend to be positively evaluated and so continue those ways of working because those positive evaluations enable them to do so (via the cycle of credibility). Thus, scientists draw upon their past experiences that have been positively evaluated (in whatever way) as constituting good research as signals that steer them in making proposals for scientific conversion. Starbuck (2003) highlights that reviewing is not just a gatekeeping role but also a way to signal to scientists what their audiences will find (more) interesting, thereby having a steering as well as gatekeeping effect in the process.

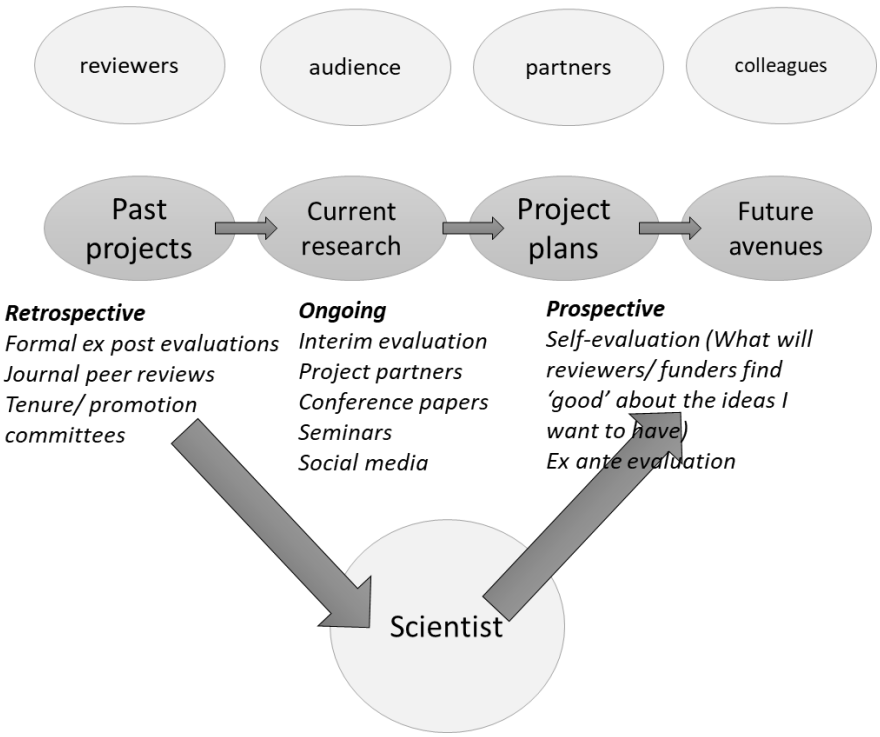
The second issue is the fact that people play multiple roles in these signalling systems, serving as reviewers, editors, colleagues (informal reviewers and mentors), supervisors and peers. Through the act of participating in various kinds of feedback and review processes, they gain insights into what constitutes 'good' research, as well as shaping what constitutes good research. Both Starbuck (2003) and Martin (2006) make recommendations based on their editorships of leading journals in their fields (management and organisation studies). They demonstrate that they also went through a learning process in overseeing their decision-making as editors. These editors were themselves path-impregnated, shaped by their experiences and their parallel desires to ensure that their respective journals were 'good' forums for the presentation of research.

The act of reviewing compels researchers to think about what constitutes good research, and to give scientists the opportunity to shape the overall direction of their field towards doing more of what they regard as being 'good' research. The multiple roles played by people in these communities shape the emergence of the definitions of 'goodness'. Being regarded as doing good research leads to more access to do good research in terms of winning resources for funding and also the publications that build credibility. But they also in turn provide access to and a voice in the decision-making forums in which these definitions of goodness emerge, for example being invited to participate in evaluations and editorial boards. Decisions about the 'goodness' of research are taken by those that have been seen to already do good research, and they allocate the resources to research that will lead those beneficiaries of the allocative decision to in the future themselves be in a position to make those judgements of goodness. This can sometime lead to the emergence of what Jones & Wilsdon call "social, political and

epistemological bubble[s]…beyond anything that can be rationalised through cost-benefit analysis" (2018, p. 6).

A scientist seeking to perform an act of scientific conversion is steered by evaluations in the past, the present and the future, and through that steering effect change the overall direction of their scientific progress and contribution: there are retrospective, contemporaneous and prospective effects of research evaluation. Retrospective signals are those from researchers' prior experiences from their path-impregnation (Knorr-Cetina, 1981), with academic identity typically formed through the research education process (Ziman, 1981) via intimate supervisor feedback and more periodic exposure to epistemic communities. Contemporaneous signals arise in carrying out research practices whether though formal interim scrutiny and mid-term evaluations or informal engagement in the course of research, asking open questions, soliciting suggestions to steer ongoing activities. Prospective signals are inferred by academics in adjusting their present activities to optimise its future scientific acceptability in these scientific governance frameworks (Boyack *et al.*, 2018). Scientists anticipate how their activity will be received and steering their plats to optimise its reception: researchers imagine these future judgements and react to these judgements not made. We summarise this in figure 1 below which highlights the various ways in which evaluations influence the decisions that scientists make based on their experience, their ongoing work and their anticipation of future impact.

Figure 1: the potential role of evaluation in the credibility cycle



Authors' own design

3.3. Open research behaviours and ex ante research evaluation

In this paper we are specifically concerned with the issue of *ex ante* research evaluation and the way in which *ex ante* research evaluation can provide a signal to researchers that helps to steer them. This steering effect comes not just through scientists preparing research proposals, but also through participating in evaluative decision-making and receiving review reports, help to constitute a well-ordered view of what constitutes good research. *Ex ante* research evaluation is relatively weakly understood despite it representing a critical link in the credibility cycle and hence the scientific research process. *Ex post* evaluations are material evaluations; there are outcomes that have been achieved and they can be evaluated against some criteria set, in terms of whether they are reasonable, logical, excellent or impactful. Those outcomes serve as a material referrent that corroborate the text that is provided by the researcher that claims the conversion; a paper or report is written but evaluators can test claims made by the scientists for their truth. If a scientist claims for a research project that they presented a conference paper, then there will be a proceedings in which that output can be located. A scientist seeking tenure will submit supporting materials, a teaching portfolio and research outputs that allow the committee to evaluate the claims that are made for scientific efficacy. Even an interim evaluation is able to look to see whether a research project is underway in a satisfactory directions and has taken the initial steps that are anteceden to achieving the finally desirable goals.

But *ex ante* evaluation lacks that explicit materiality being made on the basis of a proposal on what will be done in the future. It effectively represents a promise of what a scientist will do in the future. Effective evaluation of a proposal needs therefore to consider not merely the question of whether this is a good proposal (promising good results) but will this proposal lead to those promises being kept. Part of the credibility cycle relies on the fact that this is extremely hard to judge in the absence of material referents (an *ex post* evaluation effectively being an evaluation of whether those promises were kept). *Ex ante* evaluation in practice works on the basis at least partly on the logical consistency of a proposal and at least partly on the track record of a proposer. Those two things are taken as proxies for whether that proposal (and the proposer) is seen as being more or less likely to deliver what they have promised to do in the proposal.

In this paper we are concerned with the issue of the *ex ante* evaluation of the societal impact of research, and this serves to magnify this problem about the credibility of proposal to make a promise to create impact. Creating impact is dependent on the activities and agencies of other actors, something that is recognised in the *ex post* evaluation of research impact, and it is difficult

for a research proposal to make promises on behalf of users who may not be party to that proposal and may choose not to use the research findings in a biddable way. This runs the risk of creating an impact gap in *ex ante* evaluation, in restricting the validity of claims to what Benneworth *et al.* (2016) refer to as those lucky enough to know prime ministers, and Sivertsen (2019) refers to as working in domains to create extraordinary impact. Good research may create usable knowledge that is not used despite its usability, because of circumstance, because of deliberate choice, or indeed because of various kinds of market or indeed public value failure (Bozeman, 2002).

But building on Figure 1, the point of *ex ante* evaluation of societal impact in research proposals is not only to identify projects that will lead to impact an channel resources to them, but rather to give a wider set of signals in the field that being impactful is a desirable feature of these well-ordered science communities. Channelling resources to impactful research will help to reward those that create impactful research and in the future that impactful research should find outlets that influence communities norms. But there is also a desire to steer more widely than that, and confront researchers with a need think meaningfully about how they will create impact in their proposals. D'Este *et al.* (2016) argue that pro-social behaviour in research planning is associated with a higher authenticity – when planning of activities takes user input into account then that has a steering effect on the content of those proposals. We extend this using the idea of coupling that we developed in 2.3 to argue that a good proposal demonstrates the ways in which that a scientific project is coupled to both societal as well as scientific signals of what constitutes good research. In section 4 we turn to consider how a research proposal could couple itself to societal signals and therefore increase the likelihood of creating societally (as well as scientifically) useful knowledge.

4. Commitment to open research practices signalled in project plans

A proposal for a research project provides a framing that influences what is or is not included in the project scope, in the methods and instruments used, the data gathered, the analysis and interpretation of the results. A good research proposal offers consistency between those elements: framing aligns with scope, approach, and analytic plan, and that consistency is part of the credibility of the proposal, whether the proposal will indeed do what it claims to be able to do. We contend that this consistency constitutes a promissory resource: signalling that the researchers are coupled to a knowledge community and that there is a consistency that will lead the resultant knowledge to be coupled to the knowledge community. The question then arises of

how can that consistency be created in a research proposal to demonstrate that the knowledge will be coupled to user signals (and not necessarily to immediate user uptake).

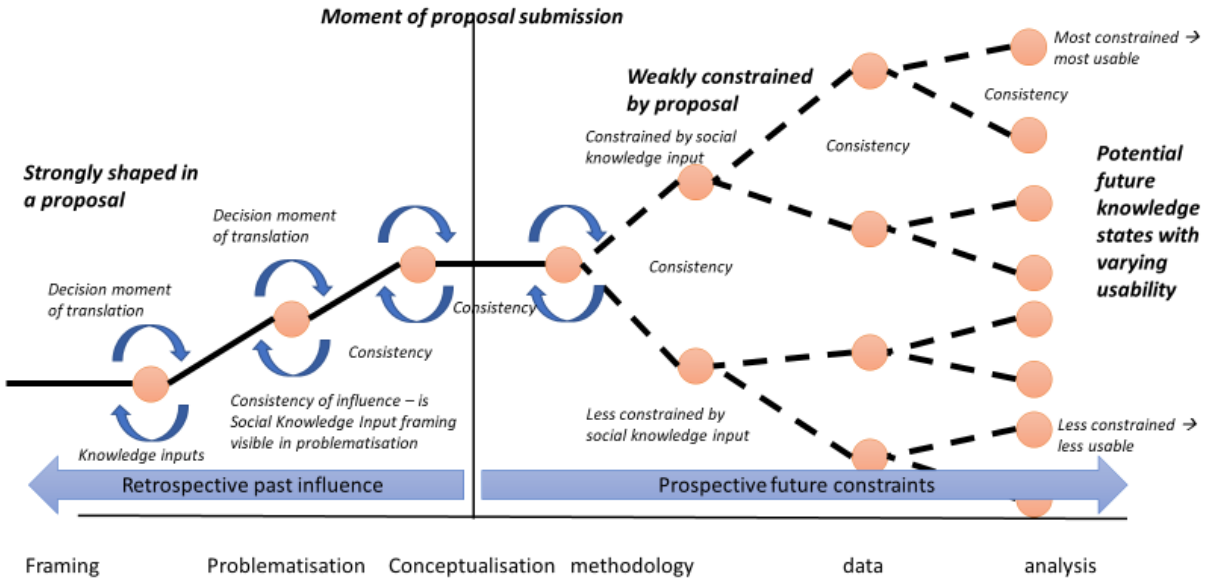
4.1. The challenge of ensuring societal coupling in a scientific research proposal.

As a thought experiment, consider the example of an existing research project proposal designed to create rigorous knowledge and is consistent in that regard. Acting out of opportunism, and a desire to secure resources, the scientist authors simply tag a social problem "framing" onto the front end of the project, to claim that their study will address a socially urgent problem, such as a Sustainable Development Goal. That social framing can potentially convey more than the purely scientific framing, and potentially has the potential to change the nature of the problematic that emerges for the proposal; there is not just a mechanism that needs understanding, but the functioning of that mechanism in context must be understood to address the societal problem. Smart grids as a purely scientific problem can be framed as an issue of dealing with two way electricity flows, metering, and grid balancing; smart grids as a societal solution require understanding the way that energy users respond to energy market incentives, planning authorities and commercial models. In this example, the societal framing, bringing in societal knowledge, imposes an *additional constraint* for which the problematisation and the remainder of the problem must be consistent. This constraint persists through the proposal, and consistency demands that the proposal demonstrates how it creates knowledge that addresses the social as well as the technical knowledge needs (even if it does not demonstrate that it will make societal partners use that knowledge).

This issue of commitment and consistency provides an external referent against which proposals can be judged on whether they have created a material dependency upon societal knowledge that improves their coupling to societal knowledge. In 2.3, we contend that coupling to societal knowledge take place in terms of five kinds of knowledge practice that incorporate external knowledge in research decisions. In this thought experiment, the social framing of smart grids represents an open inspiration practice. These openness repertoires might also be present in other research practices in the proposal. The constraint of solving the societal dimension of the problem, and the issue of users, can shape the way that the project execution is designed. The decision might be taken to co-create the technology together with user groups and shaping the project time planning and interdependencies to allow that co-creation. Resources might be allocated to those users to enable them to meaningfully participate in co-creation, expertise in co-creation might be brought in, allocations might be made for particular infrastructures to facilitate that co-creation, through open execution.

In effect, a consistent proposal takes an evaluator through a decision in which there are branches in which decisions are made, and the proposal explains not only which decisions were taken but also the reasons for taking those decisions in that way, with reference to the constraints emerging from project framing. The credibility of a promise of future research behaviour therefore depends on the extent to which it is dependent upon a prior constraint imposed by a societal consideration. These constraints – both scientific and societal - later acquire agency in the proposal as they influence in a consistent way choices regarding activities, partners, investments, dissemination. This makes the task of *ex ante* evaluation of the potential impact creation a dual one, (i) retrospectively of how far the framing, problematisation and conceptualisation have included user knowledge dependencies, and (ii) prospectively, how the remainder of the project is consistent with those constraints to remain coupled to societal knowledge signals and hence to remain usable.

Figure 2 Ex ante impact evaluation as a process of evaluating consistency of constraint application



Source: authors' own design.

In the figure above we identify how a proposal takes decisions, and a proposal at the time of writing has typically already chosen a framing, problematisation and conceptualisation, whilst method, analysis and the generation of arguments remains to be determined if the proposal is successfully chosen. This suggests that *ex ante* evaluation can consider these two elements separately: completed decisions can be evaluated on how far user knowledge has influenced choices already made in the proposal, and future decisions on the extent to which there are

elements mobilised and launched within the projects that ensure these future activities' consistency with the constraints to produce knowledge coupled to user interest. Both of these can be considered in terms of the way that the proposals are able to demonstrate that they are coupled with societal as well as scientific knowledges in the proposal process.

4.2. Retrospective past influences on the proposal

In terms of retrospective past influences of external user knowledge, there are various ways in which proposals give evidence of the ways that user knowledge has been used in a way that create these dependencies that can conserve cognateness, through framing, problematisation and conceptualisation. Framing can be considered as a boundary process which defines what should or should not be looked at, and the issue is whether that framing allows the inclusion of objects and subjects of interest to users. This is not the same as saying that users should be allowed to set the boundaries or indeed the frames, but that there has been due consideration of, and incorporation of user knowledge, in determining where the boundary should be drawn. This could include statements that it is necessary to draw the boundaries in particular ways in order to see particular kinds of objects which in turn ensure a closer relation to the real problem. Returning to the smart grids example, this is evident in terms of setting the framing to include the social as well as the technical aspects, and that being justified in terms the necessity of ensuring the technology travels from the laboratory to achieve societal change and to solve the problem.

Problematisation involves identifying an inconsistency within the boundaries set by the framing, a gap in the knowledge and a justification as to why that gap needs filling. The consistency constraint already applies that that stage in whether the problematisation identified and the knowledge gap is sufficient to address the issue as seen through the chosen framing. In terms of the smart grids thought experiment, framing it as a dual social-technical problem raises the possibility for alternative problematisations, so not just the issue of the technical problems of managing intermittency and redundancy, but the social issues of the desirability of uptake and the nature of the relationship with the market provision also being here. For the 'social' here to be able to exerts clear visible agency, retrospectively traceable, and also making possible the inclusion of new (societal) knowledges, then there can be considered to be a consistency and also this material dependency that provides the coupling of the project to the societal knowledge.

Conceptualisation involves defining the categories that are necessary to be understood in order to create knowledge that can meaningfully fill the gap. Consistency requires a traceability of the influence of the problematisation to the conceptualisation, sustaining the material dependence of the research project upon doing things that remain coupled to those user signalled interests. The

societal interests maintain their own agency and there is no reduction of the societal interest to something that will be unconditionally satisfied with the research results. In the thought experiment, there might potentially be a split between technological systems and social systems, and allow the social system to be conceptualised in its own terms, rather than purely as providing various kinds of inputs and responses to the technical system. This then again allows the societal elements here to exert agency, preventing users being as a problem that technology has to solve, but rather an element that has to be considered if the problem is to be solved rather than merely the technological challenge addressed.

4.3. Potential future constraints on the proposal

As the proposal moves from the decisions that have already been taken to the decisions that have yet to be taken, the proposal portrays the considerations that will be taken in those decisions. From that, it is possible to see how consistently those decisions will be taken mindful of the constraints imposed by the past material dependencies already established in the proposal. These are decisions that remain to be taken in the future, respectful of the need of the scientist to react to uncertainty and circumstance and to use imagination and creativity in order to understand the situation in which they find themselves. But these proposals can also provide a set of principles implicitly setting out how they will allow in the future these user knowledges that they have already introduced into the project to have an agency and an influence into the future. The issue here is of consistency, in that the **decision rules** being set out can be evaluated for the potential that they have to allow this user knowledge to influence the flow of the decision.

- Is the methodology being established consistently with the framing and problematisation in ways that will allow the necessary objects to be studied in ways that will create the knowledge to solve the problems identified by the problematisation?
- Is the data gathering looking at the objects in ways that will provide sufficient information to see the dynamics of the objects that are being considered?
- Will the analysis seek to create knowledge that provide an understanding of the mechanisms that will address the problems in terms of the framings decided at the start?

This therefore remains a discursive exercise, seeking to identify the justifications that have been made for each of the choices and tracing them back to the previous choices to examine the extent that the research remains coupled to social knowledge, with a material dependency that then serves to contribute to the overall eventual usability of the research. The justification for this is that the scientists preparing proposal have to demonstrate that they have taken these social knowledges seriously, and accepted the constraints that that brings in terms of their own

freedoms, just as scientists accept constraints imposed by the science system in terms of the selection of scientific framings. That is not the same as saying that scientists should be subject to constraints imposed exogenously, but rather that the scientists have chosen a societal as well as scientific framing, and have accepted and engaged with the constraints that they bring in order to ensure that it makes a societal contribution (usable knowledge) as well as a scientific contribution (excellent knowledge).

5. Towards an openness framework for *ex ante* research evaluation

In this paper, we seek to reflect on the role that *ex ante* impact plays in research proposals and therefore how it could be evaluated in ways that allow the evaluations to make a serious distinction between proposals with a higher or lower impact potential. In section 4, we contended that coupling to societal knowledge at various stages of the proposal process, and building consistent constraints from that societal knowledge through the research proposal to influence future actions was a more material referent for proposals than simply unenforceable claims being made. In 2.3, we set out our framework for understanding this coupling process in terms of various kinds of open research practices in which there is a deliberative incorporation of societal knowledges into ongoing research activities. Openness therefore provides a mechanism for operationalising the extent to which there has been coupling delivered in terms of both the retrospective activities in the formulation of the research proposal, and the prospective future promises made. The question of the coupling relates to the extent to which open research practices have been used to develop the research plan and the extent to which open research practices are present in the proposal in ways that allow societal influences to exert agency as the project runs.

In 2.2, we set out the various kinds of ways in which scientists couple themselves to scientific communities in scientific micro-practices, from aligning themselves to coherent paradigms, selecting research problems on the basis of literature gaps, to disseminating their research by publishing in journals offering good audiences. In *ex ante* research evaluation, there is an evaluation of consistency against the extent to which scientists are coupled to these existing scientific knowledges[6]. Some of that is in terms of the retrospective influences, the extent to which the problem's framing aligns with not just the nature of the problem but also the way that other researchers have framed it, the problematisation and demonstration that existing

[6] Indeed one of the arguments that is made for the relatively slow rise of multidisciplinary, interdisciplinary and transdisciplinary research is in the absence of the communities that already embody these norms and behaviours it is hard for m/i/td researchers to start to build up their credibility because they cannot easily couple themselves to a scientific community that are willing to in turn validate their research.

knowledge is insufficient to solve the problem, and its conceptualisation in terms of well-defined and coherent conceptual categories and frameworks. But there is also an element of a research proposal that demonstrates how the research will remained coupled to good scientific practice in the future, such as ensure open research practices, making findings open at an early stage, and with interim informal dissemination through for example conferences, seminars and other kinds of activity. These activities in a proposal demonstrate the activities that will be taken to ensure that the research remains coupled to other scientists and their scientific knowledge. Effectively, a proposal serves to show how the activity will operate within the constraints imposed by acceptable scientific practices to produce something that is scientifically productive.

It is likewise possible to reflect on the ways in which open research practices feature in a research proposal to impose well-functioning (in the Kitcher sense) constraints upon the research that ensure that the produces something that is societally relevant in some way (here defining societal relevance as being coupled to societal knowledge). It is likewise possible to make the same distinction between retrospective and prospective open practices. The retrospective practices are demonstrated as having been performed in the creation of the proposal, whilst prospective that are promised as forming critical knowledge elements in the completion of the overall research activity. The open practices do not clearly map to Latour & Woolgar's credibility cycle because research as carried out is not a linear process but instead follows a more chain-linked path; but at the same time it is possible to consider the ways in which retrospective and prospective open practices might be demonstrated in a proposal. But the practices provide a material referent to the proposal – if the proposal is able to refer to evidence of those practices having taken place, or those practices being critical elements of the research being proposed, then that increases the consistence of those practices in the proposal as a whole.

Retrospective practices are those that have already taken place at the time that the proposal has been submitted relating to the framing, problematisation and conceptualisation of research projects, and it is possible to see the ways in which that these three processes might be influenced by open research behaviours. Open inspiration practices where a researcher sees societal signals that there is a real problem could clearly relate to the problematisation of research, and potentially to its framing, as in the case of the smart grids thought experiment. Open planning practices would be evident when a proposal was able to demonstrate that it had been prepared in association with societal partners, with its choice of conceptualisation reflecting a choice of lenses that were capable of seeing those phenomena of interest to societal users. Open execution practices working with users are not just sites of data gathering but also sites of negotiation and governance that may influence framings and problematisations in ways that reflect what matter to

users as well as other researchers (Hodgkinson & Rousseau, 2009). Likewise, open dissemination practices can provide feedback from users about new phenomena requiring attention or findings that are the basis for future research, which can also shape framings and problematisations. Finally, open reframing practices, where researchers adjust their longer-term scientific paths on the basis of societal experiences can influence the framing.

Prospective practices are those practices that are promised to be undertaken in the course of the research project, the method selection, analysis and output production elements; the criterion we impose here for consistency is that fit with project knowledge dependencies (they represent more than just the apocryphal user seminars after project completion). Open inspiration practices relate to forming a problem on the basis of societal knowledge, implying that that knowledge was seen in a non-scientific knowledge conversation, and that conversation can feature later in the proposal, for example in terms of ensuring there are outputs being produced that speak to those conversations. Open planning practices imply engaging with potential users in designing those proposals, and those users' influences could potentially be evident in method(-ological) choices as well as outputs. Open execution practices involve user knowledge resources (codified and tangible) in knowledge production, so credible open execution could be built in as choosing methods or analyses that have a material dependence on resources exclusively held by societal partners. Open dissemination practices involves using dissemination as a source of knowledge reception, and building intermediate dependencies on material partners for production of outputs (for example by organising events or securing publications). Finally open reframing practices, and situating oneself in a research milieu characterised by a high orientation towards societal interaction may manifest itself in securing easier access to user knowledge in developing methods, gathering data/ analysis and producing outputs.

We have summarised these elements into the table below, and suggest that this could be operationalised to provide an evaluation protocol that could more meaningfully assess research proposals *ex ante* in terms of their potential commitment to creating usable knowledge, thereby eliminating the problems of symbolic compliance and extraordinary impact.

Table 1 Towards an openness based approach to ex ante *research evaluation of societal impact*

	Retrospective	Prospective
Inspiration	researcher sees societal signals that there is a real problem could clearly relate to the problematisation of research, and potentially to its framing.	Continuing the conversations with societal partners that led to the identification of the problem in dissemination and production of outputs
Planning	choice of conceptualisation reflecting a choice of lenses capable of seeing phenomena of interest to societal users.	Users' influences in planning evident in method(-ological) choices as well as selection of outputs.

Execution	users sites of negotiation and governance that may influence framings and problematisations	Choosing methods or analyses with material dependence on societal partners' knowledge resources (codified and/ or tangible).
Dissemination	provide feedback from users about new phenomena requiring attention or findings that are the basis for future research, which can also shape framings and problematisations.	Building intermediate dependencies on material partners for production of outputs via events or publications
Reframing	researchers adjust their longer-term scientific paths on the basis of societal experiences can influence the framing.	Using situation in user-facing research milieu to secure easier access to user knowledge in developing methods, gathering data/ analysis and producing outputs.

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