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Article

Enriching research quality: A proposition for stakeholder heterogeneity

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Abstract

Dominant approaches to research quality rest on the assumption that academic peers are the only relevant stakeholders in its assessment. In contrast, impact assessment frameworks recognize a large and heterogeneous set of actors as stakeholders. In transdisciplinary research non-academic stakeholders are actively involved in all phases of the research process and actor-network theorists recognize a broad and heterogeneous set of actors as stakeholders in all types of research as they are assigned roles in the socio-material networks, also termed 'problematizations', that researchers reconfigure. Actor-network theorists consider research as a performative act that changes the reality of the stakeholders it, knowingly or unknowingly, involves. Established approaches to, and notions of, research quality do not recognize the heterogeneity of relevant stakeholders nor allow for reflection on the performative effects of research. To enrich the assessment of research quality this article explores the problematization as a potential new object of evaluation. Problematizations are proposals for how the future might look. Hence, their acceptance does not only concern fellow academics but also all other human and other-than-human actors that figure in them. To enrich evaluative approaches, this article argues for the inclusion of stakeholder involvement and stakeholder representation as dimensions of research quality. It considers a number of challenges to doing so including the identification of stakeholders, developing quality criteria for stakeholder involvement and stakeholder representation, and the possibility of participatory research evaluation. It can alternatively be summarized as raising the question: for whose benefit do we conduct evaluations of research quality?

Key words: quality; actor-network theory; problematization; research evaluation; stakeholder involvement; stakeholder representation

1. Introduction

One crucial lesson Science and Technology Studies teaches us is that scientific research is a performative act. A large body of research on climate science exemplifies this. This research shows how climate science made the global climate 'knowable' (Edwards 2010). It stresses the ways in which knowing the climate and acting on the climate are 'dialectically related' (Turnhout, Dewulf and Hulme 2016: 66). Studies on the Intergovernmental Panel on Climate Change (IPCC) further demonstrate this by analysing how the issue of climate change is made governable (Livingston, Lövbrand and Olsson 2018) through the notion of the 'carbon budget' (Lahn 2021) and the 'global temperature' (Turnhout, Dewulf and Hulme 2016). Scientific research further shapes policy responses by contributing to the design of carbon markets (Callon 2009; MacKenzie 2009) and through integrated assessment models that influence which climate mitigation scenarios are considered feasible (Low and Schäfer 2020; Van Beek et al. 2020). These models subsequently legitimize particular contested technological interventions as necessary to limit the extent of global warming to below 1.5 or 2 degrees (see Hickel et al. 2021).

Science and Technology Studies document a wide range of science's performative effects, as the above snapshot of the body of literature on climate change demonstrates. In the research evaluation literature such performative effects are understood as the impact science has on society. Impact has emerged over the last two decades as an increasingly important aspect of research evaluation (Hessels,

Van Lente and Smits 2009; Smith et al. 2020) with assessment frameworks being developed specifically to evaluate the impact of science. Scholars who develop impact assessment frameworks understand impact as emerging from a translation process in which scientific knowledge becomes actionable knowledge (Joly et al. 2015). Conceptualizing impact as a translation process is similar to how, for instance, researchers working in Science and Technology Studies understand the work the IPCC does (e.g. Livingston, Lövbrand and Olsson 2018; Lahn 2021). The most elaborate impact assessment frameworks (see Smit and Hessels (2021) for an overview) trace such translation processes—conceptualized as impact pathways—over long periods of time and consider both the wide ranges of actors involved and the wide varieties of impact domains.

The increased value impact enjoys has been crucial to supporting and making visible types of research and engagement activities that previously were underappreciated in academia (e.g. Smith et al. 2020: 161–81). However, the development of impact as a distinct object of evaluation also solidified the divide between impact, on the one hand, and research quality, on the other. Since the assumption is that assessments of impact account for engagement with society performative effects are by and large absent in assessments of research quality. However, as research in Science and Technology Studies shows, science's performativity is not limited to what happens after research is completed. Conceptualizing impact as emerging from how research is used (Smit and Hessels 2021: 9), while remaining distinct from it, relieves scientists, at least partly, from (taking) responsibility for the performative effects that research might have (see also, Harding 1991: 2). In the context of grand societal challenges, and the role of scientific research in tackling them, current approaches to assessing research quality are a serious limitation. The problem is twofold.

Firstly, researchers increasingly seek, and are expected, to contribute directly to grand societal challenges (e.g. Hessels, Van Lente and Smits 2009; Ernø-Kjølhede and Hansson 2011). In transdisciplinary research fields, such as sustainability science, researchers develop research problems in relation to particular social and environmental issues. Stakeholders are engaged throughout the research process including in the conceptualization of the research problem and the formulation of research questions (Lang et al. 2012). Dominant notions of research quality (Langfeldt et al. 2020) do not do justice to the research practices employed in such fields. Drastically revised notions of quality are needed (Belcher et al. 2016).

Secondly, research that contributes directly to grand societal challenges plays an important role in shaping how social and environmental issues are formulated, which sustainable futures are imagined, and in assessing the feasibility of different socio-technical innovation pathways towards these futures. Research is not value-neutral (Kallis 2019: 61). Particular ways of problematizing social and environmental issues are desirable to some and harmful to others (Franssen and De Wilde 2021; see also Harding 1986: 21–2; Harding 1992). This raises questions of accountability, legitimacy, and democratic oversight (Callon, Lascoumes and Barthe 2009: Chapter 7; Turnhout, Dewulf and Hulme 2016: 70). Dominant approaches to assessing research quality do not acknowledge the stakes that human and other-than-human stakeholders have in scientific research. Nor are their perspectives part of assessments of the quality of research.

In this article, I aim to sketch a different approach to assessing research quality. The concrete proposition I develop in some detail entails including stakeholder involvement and stakeholder representation as dimensions of research quality. However, my broader aim is for research evaluation to play a more progressive role in academia and in society at large. This would differ radically from the stifling effects that currently dominant approaches to research quality have (De Rijcke et al. 2016; Miedema 2022).

To achieve this, this article introduces a new object for research evaluation: the problematization. Problematizations are, in the language of actor-network theory, reconfigurations of socio-material networks. Developing a problematization entails organizing reality in a particular way, by defining what is and is not part of the specific problem and what does and does not offer a possible way forward (see Callon 1984). I aim to position the problematization side-by-side with the impact pathway as objects of evaluation and translation processes which are both distinct from and entangled with each other. Similarly to the impact pathway the problematization involves stakeholders beyond the researchers themselves. Sometimes stakeholders figure as explicit co-producers of research problems as is the case in transdisciplinary research. At other times, stakeholders participate without being aware of doing so as researchers propose particular roles for them in their problematizations. By constituting the problematization as an object of evaluation both stakeholder involvement and stakeholder representation may be included as dimensions of research quality. Thus, this new object of evaluation allows for reflection on the (possible) performative effects of research, and the good, as well as the harm it might do to the various stakeholders involved.

The article consists of four sections. In the first section, I draw on actor-network theory to conceptualize research as consisting of three translation processes. The problematization is developed during the first and second translations while the impact pathway emerges in the third translation. In the second section, I discuss current approaches to evaluating these three translations thereby contrasting the heterogeneity of stakeholders involved in impact assessment frameworks with the homogeneity of stakeholders involved in assessments of research quality. In the third section, I discuss the political nature of problematizations including a short analysis of two competing problematizations—'green growth' and 'degrowth'—to illustrate how problematizations and socio-technical innovation pathways are always entangled. In the fourth section, I discuss three challenges to including stakeholder involvement as a dimension of research quality: the identification of stakeholders, quality criteria for stakeholder involvement and stakeholder representation, and, lastly, opportunities to involve stakeholders in the evaluation process. In the conclusion, I sum up my proposition.

2. Research as translation

Actor-network theory foregrounds socio-material networks that consist of human, other-than-human, and non-living entities as constitutive of social life. Such socio-material networks have performative effects, as John Law and Annemarie Mol explain: 'Active entities are relationally linked with one another in webs. They make a difference to each other: they make each other *be*' (Law and Mol 2008: 58, italics in original). Drawing on actor-network theory, the activity of conducting research consists, in the most general terms, in establishing new relations between heterogeneous entities and thereby bringing about, transforming, extending, solidifying, or otherwise modifying socio-material networks (see Callon and Rabeharisoa 2003: 201; Latour 2004: 37). When conducting

research we create differences in socio-material networks and thus alter the world. Or, in the words of Bruno Latour, we take part in '*the progressive composition of the common world*' (Latour 2004: 18, italics in original).

2.1 The three translations of actor-network theory

Michel Callon describes the modification of socio-material networks using the term 'translation'. To translate is to 'configure' (Callon 1980) actors in a socio-material network in which they are assigned particular roles. Callon (1984) famously describes how researchers attempted to save the scallops of St. Brieuc Bay by proposing a particular reconfiguration of the existing socio-material network in which three stakeholders—scallops, researchers, and fishermen—were assigned new roles and abilities, that is, became part of a particular problematization. Callon uses the term problematization to describe the proposals for reconfigurations of socio-material networks that researchers do. Developing a problematization also means that some aspect of reality is foregrounded while others are not. In developing a problematization, Callon explains, 'problems are identified and rendered autonomous; established facts are stated; links are postulated; whole sections of reality are pushed back into the shadows.' (Callon 1980: 209).

In more recent work, Callon, Lascoumes and Barthe (2009) describe the research process as consisting of three translations, in which the problematization is developed during the first and second translation. The first translation transports the unendingly complex world into the laboratory where a reduced, simplified version of the world is composed (see also Callon 1980). For instance, climate change became knowable through a composition of empirical data and climate modelling that reduces and simplifies the climate into a manipulable socio-material network (Edwards 2010). In the second translation, reconfiguring and enriching the socio-material network that was brought into the laboratory advances the problematization. For example, recently paleoclimatologists have argued for incorporating paleoclimate information in climate models, suggesting that a prerequisite for trusting the models' climate projections for the future should be successful simulation of past climate states (Tierney et al. 2020). In the third translation, researchers try to convey their novel proposals for reconfiguring the world back into society in the hopes that they will be accepted. In climate science, one of the ways this happens is through the reports the IPCC produces (e.g. Livingston, Lövbrand and Olsson 2018; Lahn 2021) which translate the latest climate science into what Joly et al. (2015: 441) call 'actionable knowledge'. Together, these three translations 'take the world [macrocosm in Figure 1] from one state to another' (Callon, Lascoumes and Barthe 2009: 69). Figure 1 provides a graphic representation of this process.

The researchers who attempted to save the scallops of St. Brieuc Bay engaged in the same process. They introduced the issue of the declining scallop stock into their laboratory and developed a problematization that involved, amongst other stakeholders, scallops and fishermen. They reconfigured the socio-material network, inspired by Japanese scallop cultivation practices, and assigned new roles to all the involved actors. The fishermen, for instance, had to stop fishing to allow the scallop population to regain its strength and size. The scallop larvae had to anchor themselves to ropes, like the Japanese scallops did, which would allow them to grow up in safety. The researchers brought their proposal to these stakeholders and initially the results were promising. A few scallop larvae did anchor

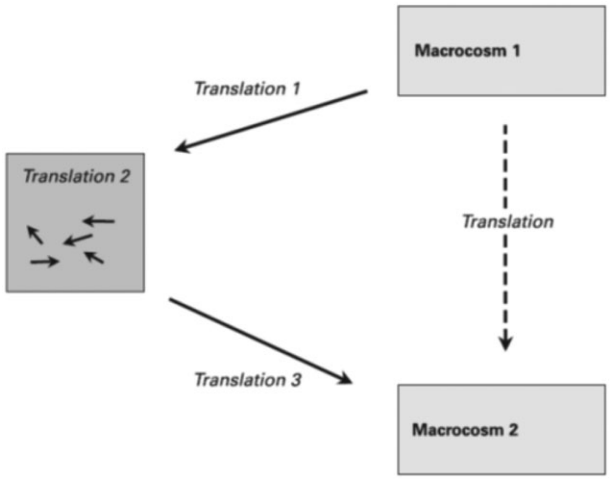

Figure 1. Callon, Lascoumes and Barthe (2009: 69), original caption: 'Translation is made up of three elementary translations which take the world from one state to another'. Macrocosms 1 and 2 represent two states of the world. Translation 1 introduces the world into the laboratory, translation 2 reconfigures the socio-material network, and translation 3 re-introduces the reconfigured socio-material network back into the world in an effort to change it.

themselves and a few fishermen agreed to refrain from fishing in the bay. However, in the end, the problematization did not hold. The scallop larvae did not anchor themselves en masse on the ropes and the few that did were caught one Christmas eve by a group of fishermen who did not want to wait any longer. Both the scallops and fishermen betrayed the reconfiguration of the world the researchers had proposed (Callon 1984: 220).

Callon is particularly keen to follow the translation of problematizations out from the laboratory into society (translation 3). This translation happens through socio-technical innovation pathways that often involve new technological objects (Callon 1986, 1990). Following in Callon's footsteps, research impact assessment frameworks such as ASIRPA (Socio-Economic Analysis of the Impacts of Public Agricultural Research) were developed to assess the processes and outcomes of this third translation process.

3. The evaluation of translations

In this section, I discuss the characteristics of frameworks used in impact assessment that take a translational approach. I focus on ASIRPA as the most prominent example but also discuss some aspects of evaluative inquiry and ImpresS (Impact of Research in the South) where they differ from ASIRPA. I pay particular attention to the heterogeneity of the stakeholders included, the extent to which different values, concerns, and interests are recognized, and the ways in which stakeholders play a role in the evaluation process. I then contrast this with the dominant approaches to assessing research quality and discuss the assumption of value-neutrality of 'basic' research which the separation between impact and quality helps to maintain.

3.1 Translational approaches to impact: assessing the third translation

ASIRPA is a framework for impact assessment the French National Agricultural Research Institute (INRA) created to assess how

scientific knowledge developed there comes to have an impact in society (see Joly et al. 2015; Matt et al. 2017). The translation process through which it occurs involves 'heterogeneous actors which play complementary roles and transform knowledge through a series of steps on the path to innovation' (Joly et al. 2015: 441). The ASIRPA framework makes a distinction between the initial research phase (translations one and two) and two impact phases during which the third translation takes place. The two impact phases together comprise, in ASIRPA's terminology, an impact pathway. The first impact phase consists of an initial set of targeted end-users acting on the knowledge produced. In the second impact phase, a wider set of intermediaries become part of the extending socio-material network (akin to what Callon (1984) calls mobilization).

The ASIRPA framework foregrounds the role of non-human entities in the impact pathways it analyses. To do so, Joly et al. (2015: 445) propose the notion of a 'productive configuration' that 'involves all the human and non-human actors mobilized' in the translation process. With productive configurations the authors build on the idea of 'productive interactions' from the SIAMPI framework (Social Impact Assessment Methods through Productive Interactions, Spaapen and Van Drooge 2011) but represent an important broadening of the latter framework's analytical scope. Where productive interactions exclusively pertain to what occurs between human actors the notion of productive configurations does not a priori limit the types of actors recognized in the translation process. ASIRPA case studies, which point to the crucial role of technological objects in the 'generalization' of impact (Matt et al. 2017: 216), highlight the importance of non-human actors in impact pathways. Without non-human objects research outcomes cannot spread nearly as far or easily through society.

The ASIRPA approach draws on two strengths in actor-network theory. First, it offers a processual, networked view of how socio-material networks must be (re)configured in the translation process for impact to emerge downstream while recognizing the role of all actors, human and non-human, involved in this process. Second, it recognizes a wide range of impact domains in comparison to other frameworks for research impact assessment (e.g. see Weißhuhn, Helming and Ferretti 2018; Smit and Hessels 2021). However, although ASIRPA researchers adopt a processual and networked approach with regard to actors and their relations, the conceptualization of impact domains and their interrelations is static. The impact domains they recognize are varied but predetermined, to allow for comparison during the assessment, and exist in relative autonomy from each other. The evaluative inquiry framework does not draw on a set of fixed impact domains and offers a more open and inductive approach to the impact of research. Its aim is 'to find out what are the central issues or ambitions, how they are operationalized, what kind of outcomes this yields and where the outcomes travel to' (De Rijcke et al. 2019: 180). It shares its theoretical foundation with ASIRPA and likewise traces impact pathways but adopts an inductive approach when it comes to possible impact domains. Doing so allows one to explore possible new impact domains without preconceptions as well as to trace the tensions between various impact domains and associated value registers (e.g. economic and environmental value registers, which are often at odds) that emerge as relevant in an impact pathway analysis.

In both approaches stakeholders participate in impact assessment. In the ASIRPA framework stakeholder interviews are used to qualify the impacts of each project. In a second step stakeholder expert panels compare cases and quantify the impact of each project (Joly et al. 2015: 447–8). The evaluative inquiry approach similarly draws on stakeholder interviews to identify impact pathways but does not include the second step of comparison and quantification using a stakeholder expert panel.

An impact assessment framework designed as explicitly participatory is ImpresS. It draws on ASIRPA's conceptualization and operationalization of the impact pathway. However, ImpresS's analysis of the impact pathway involves stakeholder to a greater extent than ASIRPA. In an attempt to mitigate power and resource imbalances among stakeholders ImpresS draws on a variety of participation methods. The developers of ImpresS state that 'participatory workshops involve a diversity of actors, while focus groups and personal interviews with key resource persons are used to triangulate results' (Faure et al. 2020: 161). In addition, similarly to ASIRPA, an expert panel is responsible for comparing and quantifying the impact of evaluated projects. Faure et al. (2020) argue that participatory methods allow the evaluators to understand more of the complexity of the innovation process than a lack of participation yields. Crucially, stakeholders identified events, actors, and drivers that the researchers involved in the project did not recognize. Stakeholder involvement thus enriched the description and analysis of the project's impact pathways.

Impact pathways are one way of conceptualizing the third translation process to allow for this translation to become object of evaluation. As the short overview above shows, developers of various frameworks for impact pathway analysis draw explicitly upon actor-network theory. This results in; (1) a processual approach to understanding impact, (2) recognition of a large variety of human and other-than-human actors (in particular non-living entities such as technologies) as stakeholders in the impact pathway, (3) a wide range of values and interests recognized in a broad set of possible impact domains, and, (4) the development of participatory methods to include stakeholders as experts in evaluation processes.

3.2 Who gets to speak about research quality? Assessing the first and second translations

Frameworks for research impact assessment have been developed to capture the ways in which scientific knowledge is translated 'outwards' to other domains of society. The essence of such a process is the development of pathways among heterogeneous domains, for instance between science and industry. This problematic is very similar to what concerned actor-network theorists in the 1980s and 1990s (e.g. Callon 1990). It is therefore not surprising that Callon's sociology of translation became foundational to the impact assessment frameworks briefly summarized above.

In contrast with the heterogeneity of domains and stakeholders considered in impact assessment frameworks, notions of research quality are understood to emerge from within relatively homogenous knowledge communities (Langfeldt et al. 2020: 116). This understanding is grounded in a sociology of science that argues scientific communities cultivate specific ways of doing which members share and pass down to new generations of scholars through immersion in the community (e.g. Hagstrom 1965; Merton 1973; Polanyi 2000). Notions of research quality are defined within knowledge communities and vary between them. However (variations on), three dimensions of quality are found in most of them: originality, reliability, and scientific value (Langfeldt et al. 2020). Understandings of quality are reproduced daily, e.g. through peer assessment of research, when peers read, discuss, and cite each

other's work. They are also reproduced in hiring committees, which constitute a formalized evaluation process (e.g. Hammarfelt 2022). Similarly, peer review constitutes an important aspect of research funding councils assessing project proposals (e.g. Lamont 2009), and (national) research evaluation exercises, such as the UK REF (e.g. Wilsdon et al. (2015), on peer review in the age of evaluation see Forsberg et al. 2022).

Peer assessment also underlies bibliometric indicators for research quality. Bibliometric indicators use citation relations (Wouters 1999) which give evidence of how academic peers draw on and reconfigure (Latour and Woolgar 1979: 105–50) each other's knowledge claims. Bibliometric indicators have grown increasingly important since the 1980s in virtually all domains of science (Aksnes and Rip 2009; Rushforth and De Rijcke 2015; Aksnes, Langfeldt and Wouters 2019; Franssen and Wouters 2019). There is a long debate over the (distorted) relation between citations and research quality and consequently over the use of bibliometric indicators in research evaluations (Aksnes, Langfeldt and Wouters 2019; Wilsdon et al. 2015). Crucial to my argument is the similarity between peer review and bibliometric indicators. Both approaches rely on peer assessment by academics who are part of a relative homogeneous knowledge community and who are assumed to share a particular notion of research quality (for an empirical exploration of this see Hug and Ochsner (2022)).

That peers assess research quality serves an important function in maintaining the status of science as a profession and as a relatively autonomous field with its own 'rules of the game' (Bourdieu 1975). For example, the introduction of impact as a new criterion in the UK REF revealed fears that this would undermine the autonomy of researchers and interfere with the self-regulation of science (Smith, Ward and House 2011: 1373; Smith et al. 2020: 41–6). Academics' pushback against 'outsider influence' in research assessments, most prominently when it comes to research quality, also serves to preserve the difference between 'basic' and 'applied' research.

Differentiating between quality and impact strengthens the distinction between 'basic' research, which is a pure, curiosity-driven form of scientific inquiry, and 'applied' research, steered by external goals, values and interests. Impact is the domain where applied research is allowed to shine. Indeed, Smith et al. (2020) find that the impact agenda has had an emancipatory effect for some. However, it does not represent the ideal form of scientific research that exclusively follows a scientific logic practiced in disciplines such as physics and mathematics and represented by historical figures such as Newton and Einstein.[1]

Criticism of the dominant approach to research quality is only marginally present in the research evaluation literature. In the context of the introduction of impact in the UK REF, the Royal Academy of Engineering argued that including stakeholders only in assessing the impacts of research is as a 'missed opportunity' and 'backward step' (Smith, Ward and House 2011: 1373). Langfeldt et al. (2020: 123) similarly note that researchers in 'applied' fields, such as engineering, make mention of relevance to society as an intrinsic aspect of their research. Researchers in transdisciplinary fields, such as sustainability science, argue that entirely new notions of research quality are needed for their research practices (Belcher et al. 2016). For example, notions of quality have to account for research practices that are problem-driven and which involve stakeholders in the research process (Belcher et al. 2016: 12). However, such critiques tend to be seen as irrelevant outside applied and transdisciplinary fields. Yet, without extending this critique, the ideal of 'basic' science as (1) an essentially value-neutral activity, (2) which does not involve stakeholders other than academics, (3) does not have any direct bearing on the 'real' world, and therefore, (4) has no need to justify itself in that 'real' world, continues to reproduced itself. Dominant approaches to research quality are complicit in the reproduction of this ideal of 'basic' science and an obstacle to foregrounding the politics inherent to all scientific research, basic and applied, when conducting assessments of research quality.

4. The politics of problematizations: in whose interest is research conducted?

In transdisciplinary research stakeholders often take active part in research processes including participating in shaping research questions and designs. In such projects their involvement in research is obvious. However, stakeholders are also present in research when they are not actively involved in the research process. One reason for this is that researchers themselves are situated socially, politically, culturally, economically in society. In the 1980s, feminist scholars convincingly argued that disinterested, value-neutral science does not exist and is also not attainable (e.g. Harding 1986, 1992; Haraway 1988). Callon, Lascoumes and Barthe (2009) make a similar point, arguing that the development and modification of a problematization is always political in nature. Drawing on Callon's (1980, 1986) study of fuel cells and electric vehicles, they illustrate:

> What is at stake in this movement [the reconfiguration of the world] is actually the form and composition of the collective in which we live. What better political questions are there, what better questions concerning the forms of common life, than those concerning whether or not a society with thermal vehicles and an oil industry is preferable to a society equipped with fuel cells … Another striking way of formulating the question is to say that what is at stake is whether or not we want to form a collective inhabited by fuel cells, electric cars, motorists who have accepted them without hesitation, industries that manufacture them, and ministers imposing environmental norms (Callon, Lascoumes and Barthe 2009: 68–9).

'What is the future that we want?' they ask. 'Is it one with electric or thermal vehicles?' Such questions regarding 'the form and composition of the collective in which we live' are political questions. Problematizations developed in research inherently contribute to particular reshapings of the world. Even if stakeholders are not actively involved in the research process researchers themselves inhabit specific social positions. In their research they consequently act upon and in the interest of particular stakeholder groups. Translations one and two are entangled with translation three and, like translation three, filled with stakeholders for whom the developed problematization might result in a reconfiguration of their world. Indeed, in both ASIRPA and evaluative inquiry the research phase (translations one and two) and the impact pathway (translation three) are understood as entangled. Joly et al. (2015: 449) note that the stakeholders involved in the research phase are not necessarily the same as those who participate in the impact pathway (Matt et al. 2017). Stakeholder involvement may be different between phases but stakeholders are involved in all of them. Moreover, the socio-technical innovation pathways that emerge from different problematizations are shaped by the latter's affordances and constraints. To illustrate this point, below, I briefly discuss two

competing problematizations and their association with particular socio-technical innovation pathways.

4.1 Green growth and degrowth: clashing problematizations and their technologies

'Green growth' and 'degrowth' are two problematizations developed in the social sciences in response to the issue of climate change[2] and frame possible climate mitigation and adaptation strategies. In the context of anthropogenic climate change, the Paris Agreement[3] dictates that signatory countries should reduce carbon emissions to a level that will maintain the planet's mean temperature increase below 1.5 or 2.0°C. How to reach this goal? The green growth and degrowth problematizations offer radically different answers to this question.

Green growth emerges from ecomodernism and argues that decoupling economic growth from carbon emissions is possible through technological innovation. Such a decoupling would allow countries to continue on their current path of economic development. Their economies would continue to grow and consumption would continue to increase, only this would happen in a 'clean' or 'green' way. Such an economy and society would look different from that of today. Societies would come to rely on a high-tech, circular, and clean-energy economy in which the electrification of transportation and heating, among other systems, would allow for the reduction of fossil fuel use (e.g. for discussion see, Milovanoff, Posen and MacLean (2020)). Green growth underlies policy frameworks such as the UN Sustainable Development Goals (Hickel and Kallis 2020) and the European Union's research and innovation policies (Pollex and Lenschow 2018).

The problematization of degrowth has developed in direct contrast to that of green growth and argues that the latter offers an unfeasible route towards meeting the goals of the Paris Agreement (Hickel and Kallis 2020). More generally, degrowth scholars argue that economic growth is not a goal worth striving for. Instead, 'the degrowth hypothesis is that it is possible to organize a transition and live well under a different political economic system that has a radically smaller resource throughput.' (Kallis et al. 2018: 4.2). Degrowth scholars thus seek to achieve the goals of the Paris Agreement in a radically different way compared to proponents of green growth.

This difference is also visible when one considers the stakeholders in degrowth research. Without offering a full stakeholder analysis, research projects the European Commission funds that mention degrowth[4] can serve as a sample. These include a research project on the global movement for environmental justice and the Environmental Justice Atlas (Temper, Del Bene and Martinez-Alier 2015) which is a global map of conflicts caused by resource extraction. A second research project examines radical grassroots innovations in agriculture that seek to 'unmake' (Feola 2019) capitalist institutions and practices. Both projects engage with and support bottom-up movements that are often critical of established state and market institutions.

The socio-technical innovation pathways explored in degrowth research are directed by its problematization. In an editorial in a special issue on degrowth and technology, Kerschner et al. (2018) argue that degrowth research has a love–hate relationship with technology. One the one hand, degrowth researchers discuss technological innovation in the context of 'green growth' critically. Such studies criticize the problematization of green growth and the institutions that adopt it, including the European Union (Pollex and Lenschow 2018), for their reliance on technological innovation (Grunwald 2018)—especially geoengineering (Gunderson, Stuart and Petersen 2019)—to 'solve' the problem of climate change. On the other, technology is also crucial to degrowth but only if it is designed and evaluated according to very different standards. In the same special issue, Vetter (2018) sets out design criteria and ethical values for technology that would support conviviality, an important concept in degrowth research coined by Ivan Illich, and the development of convivial technologies. Drawing on degrowth empirical case studies, Vetter argues for five 'ethical values or design criteria' for convivial technologies: relatedness, adaptability, accessibility, bio-interaction, and appropriateness. Degrowth scholars thus dismiss high-tech and favour low-tech socio-technical innovation pathways.

The purpose of this comparative example is to illustrate the interconnectedness of problematizations and the various directions of socio-technological innovation pathways can take. While problematizations do not determine an innovation pathway in an absolute sense (Matt et al. 2017: 210) they do have particular affordances. Socio-technical innovation pathways that emerge from degrowth develop in a different direction from the high-tech socio-technical innovation pathways preferred in green growth strategies. Both the problematization and the socio-technical innovation pathways may be regarded as reconfigurations of the world. Therefore, the development and the content of the problematization can and should be studied as a translation process involving a heterogeneous set of actors similar to the socio-technical innovation pathways analysed as impact pathways using impact assessment frameworks. Crucially, doing so entails including stakeholder involvement and stakeholder representation as new dimensions of research quality. The methodological and substantial challenges of doing so will be addressed in the following section.

5. Allowing for heterogeneity: stakeholder involvement and stakeholder representation as dimensions of research quality

Problematizations are proposals for reconfiguring a socio-material network that consists of a heterogeneous set of stakeholders. In a problematization researchers assign each stakeholder a particular role and abilities and represent them as having particular concerns. As I have argued above, stakeholder involvement and stakeholder representation in problematizations can and should be considered as dimensions of research quality. Specifically, we might assess stakeholder involvement in the *development* of problematizations and stakeholder representation in the *content* of problematizations. Doing so requires us to face three challenges: identifying which stakeholders play a role in problematizations, formulating research quality criteria to assess stakeholder involvement and representation, and including stakeholders as participants in evaluation processes.

Following the lessons learned from actor-network theory and associated impact assessment frameworks, we should take a processual approach and aim to identify both human and other-than-human stakeholders. Furthermore, we should be open to the widest range of values and concerns that may (come to) play a role in a problematization. To do so, we can draw on methods developed in impact assessment frameworks such as ASIRPA, evaluative inquiry, and ImpresS. These rely primarily on interviews with researchers

and stakeholders, document analysis, and creative methods. These approaches are suited to trace which stakeholders have been directly and actively involved in the translation process. However, identifying all stakeholders in problematizations entails including also those stakeholders assigned a role in a problematization without being aware of their role. Doing so is the first challenge.

5.1 The identification of stakeholders in problematizations

Scientometric methods provide a means to address this challenge. The potential of scientometric methods lies in the role of textual documents, what early actor-network theorists Latour and Woolgar called 'literary inscriptions', in developing new problematizations. They write:

> A laboratory is constantly performing operations on statements; adding modalities, citing, enhancing, diminishing, borrowing, and proposing new combinations. Each of these operations can result in a statement which is either different or merely qualified. Each statement, in turn, provides the focus for similar operations in other laboratories. Thus, members of our laboratory regularly noticed how their own assertions were rejected, borrowed, quoted, ignored, confirmed, or dissolved by others (Latour and Woolgar 1979: 86–7).

By constructing a new text which includes new statements supported by references, tables, and graphs, researchers enact their reconfiguration of the world. The text is thus a (textual version of) the reconfigured socio-material network (Callon 1990: 135) that becomes reality through the very act of describing it (Callon 1990: 136). Because of the role of literary inscriptions in enacting problematizations early actor-network theorists were interested in scientometric methods. Callon, Law and Rip (1986) argued that co-word analysis could be used to trace shared problematizations across large corpora of scientific publications.

Recent developments in scientometrics add promise to this old ambition. To describe problematizations in all their diversity, it is crucial to identify the widest possible range of involved stakeholders. This includes, as mentioned, human stakeholders (well-defined entities such as NGOs and municipalities and less defined ones such as 'consumers', 'citizens', 'farmers', or 'pet-owners'), non-living entities, such as technologies or the elements, as well as other-than-human creatures, including animals, plants, bacteria, or entire ecosystems. A small number of studies have experimented with manual and semi-automated approaches to using scientific publications to identify the stakeholders involved in problematizations. Evans' (2010: 406) study of the epistemic community that utilizes *Arabidopis thaliana* employs a manually coded list of 'scientific terms … that corresponded to *Arabidopsis* genes, proteins, species, techniques, biological processes, molecular functions, cellular components, developmental stages, and anatomical locations.' Foster, Rzhetsky and Evans (2015) studied innovation in chemistry through an analysis of novel chemicals and chemical relationships they culled from the abstracts and titles of scientific publications. Such approaches might be furthered, for instance, through developing ontologies for specific research domains thus enabling the identification of stakeholders relevant to a research topic. Moreover, heterogeneous network mapping, that is, the visualization of relations between diverse entities, has recently become a standard feature in the digital CorTexT platform (e.g. see Cardon and Barbier 2017). This is an important feature as it promotes the visualization of relations across the divides between human and other-than-human stakeholders.

These developments allow for scientometric methods to support of explorations of problematizations (see also Marres and De Rijcke 2020; Rafols and Stirling 2021). This does not, however, mean that scientometric analyses and visualizations enjoy a privileged position. Scientometrics do not offer a god's-eye view of science but they do allow for identifying the stakeholders involved in particular problematizations as long as those stakeholders are explicitly mentioned in the texts researchers produce.

5.2 Quality criteria for stakeholder involvement and stakeholder representation

The second challenge is to develop quality criteria and assessment procedures to evaluate stakeholder involvement and stakeholder representation. I propose drawing on Callon, Lascoumes and Barthe's (2009) work on stakeholder engagement in research and innovation processes. In their book, oriented towards organizing and improving stakeholder involvement in controversial projects such as nuclear waste disposal, they propose 'democratiz[ing] democracy' through extensive stakeholder participation trajectories. As stakeholder participation can take various forms Callon, Lascoumes and Barthe (2009: 158–61) develop three of quality criteria to compare different participation trajectories: *intensity*, *openness*, and *quality*. These quality criteria serve this article as well since they can be used to assess stakeholder involvement in researchers' *development* of a problematization.

To assess the *intensity* or depth of involvement of stakeholders in research we can consider the stage at which stakeholder involvement happens. Some researchers may involve stakeholders in the design of research questions while others only involve them after they have their research results. The *openness* of the research process includes the diversity of the stakeholders mobilized during the research process. The *quality* of stakeholder involvement indicates both the quality of the collaboration between stakeholders and researchers and the continuity of stakeholders' voices in the research process.

Reformulating the last two of these criteria allows us to assess stakeholder representation in the *content* of the problematizations. First, the *openness* of a problematization might include an assessment of the range and diversity of stakeholders represented in the problematization. Second, the *quality* of a problematization could involve an assessment of the richness, in terms of the role, abilities, and concerns assigned to each stakeholder in a problematization (see also, Latour 2004: 86). As a third quality criteria, we might add *reflexivity* to assess the extent to which researchers show awareness of and reflect upon the situated (Haraway 1988) nature of problematizations. Any problematization will benefit some stakeholders while doing harm to others (Franssen and De Wilde 2021). As generalizable solutions that are beneficial to all are very seldom available we might invite researchers to account for the ways in which their problematizations foreground the concerns of particular stakeholders over others. This quality criteria opens up questions regarding setting priorities and the extent to which research empowers stakeholders without power or reproduces existing inequalities (e.g. for an example from health research see Yegros-Yegros et al. (2020); for foundational critique from a feminist perspective see Harding (1986)).

Simultaneous assessment of stakeholder involvement in the *development* of, and stakeholder representation in the *content* of, a problematization allows for reflection on the tensions between these

two dimensions of research quality. We may find that stakeholders involved in the development of a problematization also figure in articulated ways in its content. Or we may find that, within a particular discipline, all active research groups working on a particular topic involve certain stakeholders while systematically disregarding and not actively involving other types of stakeholders in the problematization.

5.3 Towards participatory research evaluation?

The third and last challenge is to determine how to involve stakeholders in the evaluation process itself. As outlined above, stakeholders are involved in the analysis and assessment of impact pathways in most frameworks of research impact assessment. The extent of stakeholder involvement differs but stakeholders are found to act as informants for the description of impact pathways (ASIRPA, Evaluative Inquiry, ImpresS) and as members of expert panels to qualify impact in particular impact domains (ASIRPA, ImpresS). However, stakeholder participation in such assessments of research impact also has important limitations. The developers of ImpresS, for instance, point to the power balance among stakeholders and their fair selection as key difficulties in the evaluation process (Faure et al. 2020).

In the context of assessing stakeholder involvement and stakeholder representation these limitations are particularly important. As outlined in the section on the two new dimensions of research quality, the aim is to assess and allow for reflection on the diversity of stakeholders involved and/or represented, the richness of their involvement and/or representation, and the openness of the research to established and emergent stakeholders. It is therefore impossible to define all relevant stakeholders for participation in the evaluation process ahead of time. Doing so would lead to already-powerful, visible stakeholders being overrepresented while less-visible stakeholders would be ignored—something this approach explicitly tries to prevent.

A possible solution would be to develop participatory trajectories after the research evaluation process is conducted. For instance, in the case of large research evaluation exercises covering all departments in a particular research field (as is the case in the Netherlands and the UK REF) a particular type of stakeholder or a particular problematization might be selected for an in-depth participatory process. To design such a process scholars of research evaluation might find inspiration from work in the field of responsible research and innovation (e.g. Stilgoe, Owen and Macnaghten 2013; Macnaghten 2021; Smith et al. 2021). Participation trajectories developed in responsible research and innovation are often extensive and aimed at enriching the research process and open problematizations up to new stakeholders and concerns rather than closing them down (Stirling 2008). These are qualities dominant approaches to research quality currently miss.

6. Conclusion

This article argues that it is possible and necessary to include stakeholder involvement and stakeholder representation as dimensions of research quality. Research quality is currently understood by research evaluators and most academics as something that can and should be judged only by academic peers or by using bibliometric indicators derived from peer assessments. This approach neglects the performative effects of researchers and the perspectives of stakeholders, whether human or other-than-human, that are assigned roles, concerns, and abilities, and whose worlds are reconfigured through research. To allow for inclusion of stakeholder involvement and representation as dimensions of research quality, I argue for a new object for evaluation: the problematization.

Following insights from actor-network theory, I conceptualize the process of conducting research process as consisting of three translations. The first two translations include the development and modification of a problematization. The third translation encompasses the socio-technical innovation pathways that take research results from science into society. These impact pathways constitute objects of evaluation in research impact assessment frameworks like ASIRPA. Stakeholder involvement is crucial to impact assessment frameworks. It is, however, not considered in dominant approaches to evaluating research quality because the only stakeholder group considered relevant are fellow academics. Constituting the development of problematizations as objects of evaluation allows for the identification of a heterogeneous set of actors involved in research projects and consequently how these stakeholders are involved and represented in research can become object of assessment.

This article is itself a proposal for a reconfiguration of reality, an invitation to scholars in the research evaluation community to do things differently. We need to develop evaluative methods that allow for including the considerations of stakeholders in evaluation processes. In some cases, this may entail direct involvement, for instance, by the inclusion of patients on panels reviewing health research. This is a step forward but in such evaluation processes patients are understood to assess the possible impact of project proposals not their quality. Taking my cue from transdisciplinary fields like sustainability science and considering the role science plays in policy responses to grand societal challenges I hold that we can no longer treat research quality as an exclusively academic affair. Our evaluative frameworks should be adapted to this moment in time, which Crutzen (2006) has termed 'the Anthropocene', and our notions of research quality should allow for heterogeneous sets of actors and their considerations to become visible when research quality is assessed.

The issue this article raises can also be formulated as a question: For whose benefit do we conduct evaluations of research quality? The answer to this question is not often explicitly articulated. Even if science generally is dedicated to advancing 'the greater good', we should debate who gets to determine what that greater good is. If science is truly for the people (and the plants, animals, and other entities with which we cohabitate Earth), research evaluation should aim to support reflection on research's performative effects and the various conflicting concerns and interests that shape its direction. Until it does that it cannot act as a progressive force in science and in society at large.

Notes

1. Harding discusses the way in which the mathematical statements Newton and Einstein developed are used to counter feminist critiques of 'pure' science, and why physics and mathematics should instead be understood as non-paradigmatic science (Harding 1986: 41–51).
2. The range of pressing environmental issues extends beyond the rise in the globe's temperature and includes biodiversity loss, ocean acidification, and the disturbance of the nitrogen cycle.

However, as a hierarchy emerges in the problematization of issues in The Paris Agreement and IPCC reports, climate change arguably is constituted as the dominant problem.

3. https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement.
4. A search on the https://cordis.europa.eu/ website for 'degrowth' yielded information on projects in which the term degrowth is used in the project description and/or in the descriptions of output.

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