Engaging Science, Technology, and Society

ORIGINAL RESEARCH ARTICLE

Commitment Issues in Science & Technology Studies: On the Necessity of Compromising One's Principles

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Abstract

There have been longstanding discussions regarding the place of normative commitments in Science and Technology Studies (STS) scholarship. Analysing STS critiques of Innovation Studies and accounts of the institutionalisation of RRI in the European Union, the article highlights how co-productionist scholarship often commits to second-order (meta-governance) principles rather than first-order (substantial) principles. Relating this tendency to the debate surrounding the third wave of science studies and Norwegian philosopher Hans Skjervheim's liberal dilemma, the article emphasises the importance of distinguishing formal and substantial commitments and recognising that the reification of norms (e.g., in governance and prescriptive frameworks) requires translating those norms into substantial principles. This also requires delimiting those principles. The article provides three suggestions on how STS scholars may relate to normative commitments.

Keywords

reflexivity; formal and substantial principles; normativity; scholarly commitments; studies of innovation

> FIRST GOD: "Should we admit our commandments to be deadly? Should we renounce our commandments? (*Sullenly*) Never! Should the world be changed? How? By whom? No! Everything is in order!"
> —Bertolt Brecht, *The Good Woman of Szechwan*

Introduction

Science and Technology Studies (STS) scholarship often resides in the gap between what is and what could be. STS is committed to in-depth studies of science and technology, often with the goal of showing that it could have been otherwise. This comes with an implied imperative: it *should* be otherwise. However, it is not always obvious what "otherwise" means, nor how to get there. Though

To cite this article Bård Torvetjønn Haugland and Alexander Myklebust. 2026. "Commitment Issues in Science & Technology Studies: On the Necessity of Compromising One's Principles." *Engaging Science, Technology, and Society* 12: e3217.
https://doi.org/10.17351/ests2023.3217.

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STS critiques are often accompanied by a commitment to broad ideals such as democratisation, reflexivity, responsibility, and inclusion, there are rarely indications of which steps or goals to pursue in order to bring these ideals closer to reality. In other words: STS scholars are adept at describing the gap between what is and what could be but provide few instructions on how to seal it. Of course, the gap may simply be left open; however, the critical orientation of most STS scholarship suggests a desire to seal it. With this article, we suggest that any attempt to seal this gap requires a commitment to substantial normative principles, as opposed to formal ones.

Scholarship in STS has been concerned with normative questions since the field first emerged. Early STS scholarship consisted of two streams: one committed to analysing the production of science and, later, technology; another committed to activism (Jasanoff 2016; Sismondo 2008). Both streams have been concerned with normativity, though each stream has approached it from different angles. The analytical stream has sought to expose the hidden values in the supposedly value-neutral activities of science; the activist stream has highlighted the close-knit relationship between science, technology, and power. In both modes, STS scholars were—and still are—proficient at showing what has become something of a slogan within STS: that "it could be otherwise" or "it could have been otherwise" (e.g., Ashmore 1994, 158; Woolgar and Lezaun 2013, 321; Nowotny and Schot 2018).

In a widely cited critique of STS, political theorist Langdon Winner suggested that the insistence that it could have been otherwise was part of the problem of STS. Though STS scholars proved, time and again, "that the course of technological development is not foreordained by outside forces but is, instead, a product of complex social interactions" (Winner 1993, 375), they did not come up with "anything like a program for positive change or a theoretical perspective that anticipates anything better than the current course of events" (ibid., 376; for a similar critique, see Guggenheim and Nowotny 2003). To this, we would add that STS scholars have grounded their efforts in normative commitments to reflexivity, responsibility, and democratisation, but that such commitments—especially how they appear in co-productionist scholarship—are better suited for critique than positive societal change.

With this article, we explore the normative commitments claimed by some STS scholars working from a co-productionist perspective, the limitations of this particular type of commitment, and alternative ways of approaching normative commitments. Specifically, we investigate these topics with regards to innovation. STS has had a complicated relationship with innovation, including Innovation Studies and innovation governance. In a recent article, STS scholar Alan Irwin articulated an inherent difficulty for STS engagement with innovation: "As STS scholars, we cannot simply stand against innovation. And yet working to facilitate it risks heavy compromises and co-option" (Irwin 2023, 42). Innovation offers a useful starting point for approaching STS scholars' commitments for two interrelated reasons. First, innovation has concerned STS scholars for decades, and the relationship with Innovation Studies has been important for STS to define its own characteristics. Second, STS engagements in innovation governance, in particular through the EU's responsible

research and innovation (RRI) efforts, offer a unique glimpse into how STS scholars relate theory to practice and how they evaluate the institutionalisation of their own principles.

We reconstruct a specific criticism which paints Innovation Studies as positivistic, mechanistic, and lacking reflexivity, and spell out reasons why we find that such criticisms do not hold. Turning to RRI in the EU, we show how the attitudes afforded by the aforementioned line of critique might hinder STS scholars' efforts to engage with innovation governance in a manner which can achieve substantial results. Noting that the arguments in the previous two sections converge around co-productionist positions, we briefly recount the debate surrounding the third wave of science studies. This debate suggests that co-productionist positions may come with a specific type of normative commitment which is formal rather than substantial. In an effort to clarify what it means for normative commitments to be substantial, we show how STS scholars who engage with Innovation Studies and innovation governance face a dilemma analogous to what philosopher Hans Skjervheim termed the *liberal dilemma*, which points to the necessity of compromising on one's principles. Finally, we give concrete suggestions to how the dilemma STS faces can be dealt with, by outlining what making substantial commitments with regards to innovation could look like for STS scholars.

Standing Up to the Hegemon

STS and Innovation Studies grew up together (Williams 2019). As the two disciplinary siblings have matured, they have had a sometimes close, sometimes more distanced relationship. As with many siblings, in some instances it is quite hard to tell them apart. This is the case with regards to the notion of sociotechnical systems, which draws on both systems of innovation and STS literatures (e.g., Geels 2004). STS has had a tendency to cast itself as the younger sibling (Martin, Nightingale, and Yegros-Yegros 2012), and has long criticised Innovation Studies (e.g., Pinch and Bijker 1987, 21–22). Arguably, STS has done so in order to carve out its own identity in the broader space of the study and governance of science, technology, and innovation.

In a recent thematic collection in *Engaging Science, Technology, & Society*, Alan Irwin carefully describes the relationship between STS and Innovation Studies, including overlaps, collaborations, and divides (Irwin 2023). According to Irwin, epistemology is one aspect where the two have parted ways. Irwin's argument regarding the epistemological basis of Innovation Studies and STS builds upon STS scholar Robin Williams' (2019) account of the origin and development of the two fields. In Williams' estimation, social studies of science, technology, and innovation have coalesced into two scholarly fields characterised by different epistemic stances: the constructivist STS and the positivist Innovation Studies (ibid., 504). Discussing what he calls the epistemic system of national systems of innovation (NSI), Williams points out that Innovation Studies scholars themselves have noted how the NSI concept has drifted away from what it was at the outset. The field's contextual sensitivity waned as it was institutionalised and operationalised (ibid., 511–512). Williams concludes that STS has emphasised reflexivity, whereas Innovation Studies has mostly failed to reflect on its own epistemological stance (ibid., 515). The same diagnosis of a reflexivity deficit can be found in STS

scholar Sebastian Pfotenhauer's (2023) contribution to the same thematic collection. Both Williams and Pfotenhauer do, however, concede that there is a shift towards more reflexivity in Innovation Studies (Williams 2019, 515; Pfotenhauer 2023, 102). Still, these accounts exemplify how STS literature on innovation employs the term *reflexivity* to distinguish STS approaches to the study and governance of innovation from that of Innovation Studies.

Critical Studies of Innovation is a relatively recent strand of innovation research. It has strong ties to STS, and argues that Innovation Studies embody a simplistic, unilinear, universal, and mechanistic understanding of innovation. Benoît Godin, a key figure in this field of study (Brandão and Bagattolli 2023; Gaglio, Godin, and Pfotenhauer 2019; Godin 2015, 2017; Godin and Vinck 2017) argued that Innovation Studies have a pro-innovation bias and adhere to market ideology and a technology-centred understanding of innovation. This characterisation suggests that Innovation Studies support (or even represent) a hegemonic view of innovation which eclipses and marginalises alternative understandings of what innovation is, can be, or should be. For example, Pfotenhauer claims that STS problematises innovation whereas Innovation Studies embraces it:

> For IS scholars, the pursuit of innovation is generally seen as self-evidently desirable and the mechanics of innovation are relatively well understood and follow universal rules and rationales everywhere, even if national innovation systems differ in their designs. (Pfotenhauer 2023, 98)

Pfotenhauer's contention builds on Pfotenhauer and Juhl's (2017) claim that the NSI framework within Innovation Studies is mechanistic and apolitical. In their view, this framework is part of a set of innovation models that presuppose the existence of a technology–market dyad, a presupposition that characterises ideas of innovation after World War II. However, Pfotenhauer and Juhl find that although the NSI framework appears apolitical, the attitude towards innovation policy that follows from this framework allows policymakers and bureaucrats to restructure other policy domains and social institutions in pursuit of innovation (ibid., 77–78).

The technology–market dyad approach to innovation policy is described as technocratic and driven by technical rationality, which gives legitimacy to political interventions (ibid., 79–80). This is contrasted with an STS perspective on innovation: "Our co-productionist key premise is that quasi-scientific innovation models are always at once models of governance, and hence deeply political" (ibid., 80). This statement implies that Innovation Studies scholars are not aware of the political implications of their models. Pfotenhauer and Juhl proceed to highlight how STS research on Responsible Innovation has influenced the innovation literature and discourse by emphasising values such as inclusion and reflexivity, and how Responsible Innovation has illuminated the political nature of innovation as well as "opened up new avenues for involving those on whose behalf innovation is commonly sought" (ibid., 87). This presents STS as superior to the NSI framework used in Innovation Studies, by virtue of the former's attention to complexity and normative issues. Yet, we find, the critics' own normative commitments remain implicit.

Similar views to those recounted in the previous paragraph are expressed by Pfotenhauer and Jasanoff (2017), who question the way that innovation has become the answer to virtually

everything. They argue that although innovation models claim to be attentive to context, context is often considered a barrier to a model's functioning (ibid., 785–786). Working from a co-productionist approach, they suggest that sociotechnical imaginaries become visible when nation states attempt to implement specific innovation models. While Innovation Studies is represented as having trouble recognising that their purportedly universal models often fail to function as intended in the real world, STS is represented as providing the intellectual resources to critically investigate the meeting between models and reality, in particular, how the implementation of supposedly apolitical innovation models exposes the reasons why the states in question try to implement the models to begin with.

Above, we have seen two characterisations of the difference between Innovation Studies and STS. First, Williams and Irwin's claims regarding differing epistemological standpoints; second, Critical Studies of Innovation's claims that the Innovation Studies field is characterised by a pro-innovation bias and a belief in the self-evident desirability of innovation. The two overlap in that they point to reflexivity as a key feature that distinguishes STS from Innovation Studies. Williams and Irwin bring this out by pointing to the different epistemic stances, with the implication being that a (supposedly) positivist epistemology leaves less room for reflexivity than a constructivist one. Critical Studies of Innovation diagnose a reflexivity deficit regarding politics: Innovation Studies scholars are charged with being unaware of the political implications of their models, which makes it appear that the models reshape society without friction.

We find that these criticisms directed towards Innovation Studies and NSI have serious weaknesses. However, these weaknesses are still interesting, as they can tell us something about the STS positions from which they are made. We therefore want to delve further into Williams and Irwin's characterisation of Innovation Studies as positivist. First, there is the issue of conceptual clarity. It is not sufficiently clear exactly what they mean by the term "positivist." The term has a whole range of possible meanings, which can involve everything from a commitment to the unity of science to empirical methodology. As long as it is not made clear precisely what the term entails in such a critique, it is unable to serve any function other than to point out approaches that are not constructivist. Second, there is an issue of scope. It is questionable to use NSI as a proxy for the epistemology of Innovation Studies as a whole. Doing so ignores another key strand within Innovation Studies, namely evolutionary economics (on these two key strands of Innovation Studies, see Papaioannou 2020). It also excludes the many offshoots and overlaps with other fields, such as the regional innovation systems literature in economic geography and the sustainability transitions literature, which combines ideas from STS and Innovation Studies.

Even if the NSI literature was a useful proxy for Innovation Studies, the concept was arguably built on anti-positivist foundations. In Williams' engagement with the NSI perspective, he identifies Christopher Freeman and Bengt-Åke Lundvall as key figures in its development. Looking at their writings, however, one would be hard pressed to find positivistic tendencies. Freeman emphasised a historically oriented and context-sensitive approach to studying innovation (Freeman 2019, 1995) and was expressly critical towards positivism (Freeman 1982). Lundvall infused his discussions of

such systems with a notion of discursive rationality borrowed from the anti-positivist philosopher Jürgen Habermas (Lundvall 1992). These points do not entirely rule out the possibility that some contributions to the NSI literature have positivistic aspects, nor that it has been taken in a positivist direction since its conception. However, they make it clear that the basic idea of NSI, as it was formulated by two of its originators, should not be written off as beholden to a positivistic epistemology. With this in mind, the claims of Innovation Studies as positivistic seem not to explicate this field's epistemological foundation as much as they function to place STS in the position of a challenger against a stronger (positivist) opponent. Taking this challenger position, the epistemology of STS becomes the opposite of whatever is challenged, while it remains unclear what substantive alternative STS can offer.

Critical Studies of Innovation's characterisation of Innovation Studies suffers similar problems. Claims regarding universal rules and mechanistic thinking appear imprecise when considering the above points, as Innovation Studies scholars have aimed to develop historically oriented and context-sensitive approaches and explicitly rejected positivism. To this day, mission-oriented innovation policies, which build on the Innovation Studies tradition and its concept of systems of innovation, aim to foster processes of innovation that include public engagement, and align innovation efforts with public values (European Commission and Mazzucato 2019). Considerations of normative issues and directionality in a wide sense were part of the basis from which Innovation Studies as we know it today emerged. For instance, scholars at what would become an important institution for Innovation Studies, the Science Policy Research Unit (SPRU), debated *The Limits to Growth* in the 1970s. Freeman argued that continued growth would not necessarily entail stepping over planetary boundaries, and argued that some types of growth could alleviate poverty without deteriorating the environment (Freeman 1973, 10).[1] Furthermore, today's directional innovation policies have a forerunner in a 1993 EU report written and edited by Innovation Studies scholars, which outlined directional innovation systems policy for sustainability (Commission of the European Communities, Soete, and Arundel 1993; Robinson and Mazzucato 2019, 938).[2] Such instances should make it difficult to dismiss Innovation Studies, at least the NSI tradition, as non-reflexive and as mechanistically applying universal rules.

By assuming the narrative presented by Critical Studies of Innovation, STS scholars take the role of an outside challenger that stands in opposition to what they see as the hegemonic

[1] While not using the term directionality, Freeman expressed a very similar notion, writing that: "In our view the Growth versus No Growth debate has become a rather sterile one of the Tweedledum/Tweedledee variety, because it tends to ignore the really important issues of the *composition* of growth in output, and the *distribution* of the fruits of growth. Some types of growth are quite consistent not merely with conservation of the environment, but with its enhancement. The problem, in our view, is a socio-political one of stimulating this type of growth and of more equitable distribution, both between countries and within them" (Freeman 1973, 10).
[2] Parts of the discussion of directional policies in the report also appeared in Freeman and Soete (1997).

understanding of innovation, including its pro-innovation bias and the market–technology dyad. As challengers of the hegemony, STS scholars' own assumptions and beliefs remain unarticulated, though they can be assumed to speak for a series of views that do not fit within the current hegemony. In other words, reflexivity is offered as a corrective to the narrow understanding of innovation allegedly championed by Innovation Studies, without it being clear or sufficiently supported that Innovation Studies has such a narrow vision or how STS approaches to studying innovation and informing innovation governance are substantially different.

Responsible Research and Innovation and Its Co-option

Above, we have discussed STS critiques of Innovation Studies which emphasise the latter's supposed lack of reflexivity. STS scholars have levelled similar critiques against innovation governance, with attendant claims of STS ideals being reified and co-opted in the EU's Horizon 2020 framework programme for research and innovation. We now look to the operationalisation of RRI in Horizon 2020, as well as reflections on this operationalisation by some key contributors (de Saille 2015; Owen, von Schomberg, and Macnaghten 2021; Rip 2016; Strand and Spaapen 2021).

The term "responsible research and innovation" was first used in 2007 (de Saille 2015, 156), though its roots in policy and academia run deeper (on policy, see ibid.; on the academic genealogy, see van Lente, Swierstra, and Joly 2017; Rip 2016). There is a complicated connection between RRI and the related notion of responsible innovation (RI). For example, Smolka, Doezema, and von Schomberg (2024, 3) point out that responsible innovation has academic roots, while responsible research and innovation is "a public policy discourse originating in the European Commission's Science in Society program." It is outside of the scope of this article to sort out the nuances of the RRI/RI debates, and in the following, we discuss contributions which, regardless of the term used, are relevant to RRI in Horizon 2020.

RRI was integrated in the EU's Horizon 2020 framework programme for research and innovation in 2014 (de Saille 2015, 153; Owen, von Schomberg, and Macnaghten 2021, 222). STS scholars who have recounted their experience with shaping and doing RRI in Horizon 2020 express disappointment and disillusionment with RRI failing to deeply change or improve innovation governance. This is perhaps most clearly expressed by STS scholar Roger Strand's claim that upon institutionalisation, the "pure ideas about reflexive science originating from STS and all the other relevant SSH fields become co-opted, contaminated and perverted" (Strand 2019, 58). Below, we present and discuss two articles written by STS scholars who took part in conceptualising and institutionalising RRI (Owen, von Schomberg, and Macnaghten 2021; Strand and Spaapen 2021).

In a 2021 article, Richard Owen, René von Schomberg, and Phil Macnaghten, three of the scholars who contributed to the conceptualisation of RRI in the EU, reflected on the impact of RRI a decade after this concept was first articulated by philosopher René von Schomberg (European Commission and von Schomberg 2011). In their retrospective, they draw upon Critical Studies of Innovation scholars Pfotenhauer and Juhl (2017) to describe RRI as challenging the market–technology dyad and the apolitical view of innovation. Thus, they align RRI with Critical Studies of

Innovation's characterisation of Innovation Studies, including the latter's purported pro-innovation bias.

Owen, von Schomberg, and Macnaghten point out that early visions of RRI were fairly consistent in their emphasis on how innovation should be "anticipatory, ethical, reflexive, engaged (with publics and stakeholders), open and mutually responsive in terms of their agendas and trajectories" (Owen, von Schomberg, and Macnaghten 2021, 223). However, they explain that RRI became tied to six keys—engagement, gender, ethics, science education, open access, and governance—which "reflected action lines (and topics within these) in the Science in Society (SiS) work programme" (ibid., 223), a Horizon 2020 predecessor. According to Owen, von Schomberg, and Macnaghten, tying RRI to the six keys effectively meant that the more ambitious vision of RRI—to make innovation responsive to societal challenges—was lost, and that many gave up on this vision. Still, the authors conclude that the challenge to the market–technology dyad should be reenergised and that RRI's vision is more important than ever (ibid., 226–228).

Strand and Spaapen (2021) give a similar account of how RRI failed to live up to its vision, and like Owen, von Schomberg, and Macnaghten, they also claim the six keys diluted RRI's original vision. Strand and Spaapen were given the task of developing a set of RRI indicators and sought to integrate the philosophical underpinnings of RRI's vision into the keys (ibid., 46). They recount how their mandate was to develop these indicators as SMART (specific, measurable, attainable, relevant and timely), and wryly comment: "In other words, the mandate was quite far from von Schomberg's vision of philosophically informed self-governance among researchers who sought reflection and deliberation in civil society" (ibid., 46).

Strand and Spaapen describe how they took it upon themselves to develop indicators that would be compatible with a network approach or co-productionist perspective, grounded in STS work (ibid., 50–53). This approach recognises that innovation is created in networks of different kinds of stakeholders, not just by researchers, and that responsible innovation in different cases will involve different sets of stakeholders with different sets of views and interests. Overall, Strand and Spaapen emphasise how responsible innovation should facilitate stakeholders to work together to solve societal problems, rather than tie innovation to any specific top-down procedures or solutions. In sum, Strand and Spaapen find that although RRI became tied to the six keys and failed to live up to the original vision, it represented a step towards integrating co-productionist insights into innovation governance.

The two testimonials on RRI discussed in this section share the same overarching narrative. RRI started with a vision of a new type of innovation governance where societal actors and innovators would become mutually responsive towards the societal impacts of innovations (European Commission and von Schomberg 2011). However, this vision never crystallised: rather, it was watered down by being tied to the six keys. Though RRI was institutionalised, this was not an institutionalisation of the STS concepts and approaches that undergirded RRI to begin with.

How could the ideas of RRI developed by these scholars be co-opted? The following quote from Owen, von Schomberg, and Macnaghten offers some clues:

> . . . we argue the need to resist attempts to reify RRI as a set of disparate keys, including the institutional impulses (well-intentioned though these may be) driving such attempts in the guise of making RRI pragmatic, actionable and measurable. In part, we have argued instead the need to return to and regain some of the substance of the original visions made by RRI's early protagonists, of which we as authors are three. (Owen, von Schomberg, and Macnaghten 2021, 223)

Owen, von Schomberg, and Macnaghten (ibid.) call for a return to the *substance* of RRI's original vision, thus indicating that the reification of RRI in Horizon 2020 was either not substantial, or did not correspond to the original substance. We find it hard to see exactly what is meant here. On the one hand, they claim that the substance of RRI has not been realised. On the other, they recognise that the RRI that was funded through the Horizon 2020 programme succeeded in "significant capacity building, community building and internationalisation" (ibid., 227). To us, these outcomes—capacity building, community building, and internationalisation—seem to represent substantial progress.

Despite these explicit pleas to return to the *substance* of the vision, we do not find that Owen, von Schomberg, and Macnaghten give clear substantial content to RRI that would be possible to operationalise or could give a new direction for innovation governance. Although the authors promote overarching norms and values relating to how governance ideally should be open, inclusive, and reflexive, they do not specify substantial outcomes or specific system changes. Similar overarching and largely unspecified commitments can be seen later in the text, where the authors "stress a kind of innovation that privileges collaboration, empathy, humility and care (for others, our planet and for the future), normatively underpinned by goals such as the SDGs [Sustainable Development Goals], as opposed to one that stresses competition, individualism and carelessness" (ibid., 228). While it is hard to disagree with such a conception of innovation, it is also not obvious how such a conception of innovation could be operationalised.

Without wanting to undermine these authors' experiences, we suggest that the disappointment expressed regarding RRI's institutionalisation might, at least in part, be explained not in terms of the substantial content of the original vision of RRI being hindered, but rather that the original vision lacked substantial commitments to begin with. Rather than specifying the desired aims and outcomes of responsible research and innovation, the original vision of RRI appears to only have provided second-order norms of meta-governance. The six keys, on the other hand, could be seen as an attempt to reify RRI and make it actionable.

To shed further light on the normative commitments claimed by these scholars, and the challenges of institutionalising these commitments, we turn to an academic exchange which preceded the institutionalisation of RRI in Horizon 2020 and wherein the original vision was articulated. The exchange concerned the normative orientation of RRI and RI and took place between the three authors who above described themselves as amongst the "early protagonists" of RRI (ibid., 223). von Schomberg initially defined RRI in this manner:

> Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical)

> acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society). (European Commission and von Schomberg 2011, 9)

In a seminal RI article, Stilgoe, Owen, and Macnaghten (2013) indicated that they found von Schomberg's definition too specific, as it was "anchored to European policy processes and values" (ibid., 1570). Writing from the perspective of RI, the authors proposed the following definition of RI: "Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present." (ibid.).

To arrive at a universal notion of responsibility which could serve as a principle for innovation *governance*, Stilgoe, Owen, and Macnaghten synthesised a series of insights and key texts from STS into four dimensions: anticipation, reflexivity, inclusion, and responsiveness (for elaboration, see table 1). These dimensions were an attempt at operationalising responsibility so as to make it possible to embed in governance (Stilgoe, Owen, and Macnaghten 2013, 1573–1574). However, Stilgoe, Owen, and Macnaghten were "reticent to explicitly define the normative ends of responsible innovation" (ibid., 1577). Rather, they chose to "[concentrate] on the means of governance such that an improved – more democratic or more legitimate – consideration of ends becomes possible" (ibid., 1577). Hence, while the four dimensions help operationalise RI, they too lack notable ends beyond realising responsibility as a meta-governance principle.

In our estimation, the original definitions of RRI and RI (and its four dimensions) exhibit norms and commitments that appear to be procedural in indicating some overarching norms for how innovation processes are to be governed, but refrain from indicating clear end goals or desired substantial outcomes. The case of the co-option of RRI in the EU, together with the STS critique of Innovation Studies reconstructed in the previous section, are together indicative of a general disavowal of substantial commitments in the co-productionist tradition in STS, which we will explore further in the following section.

Table 1. The four dimensions of RI. Source: based on Stilgoe, Owen, and Macnaghten 2013, 1570–1573.

Dimension	Description
Anticipation	Using a variety of methods for systematically considering the (positive and negative) ramifications of new science, technology, and innovation
Reflexivity	Fostering awareness regarding the value systems that underpin science and innovation, including the value systems of individual researchers as well as scientific institutions and the political institutions that articulate science and innovation policies
Inclusion	Employing a diversity of methods for promoting deliberation and ensuring that all relevant voices are represented, as to open up issues that would otherwise be left to experts
Responsiveness	Developing the capacity to change current direction(s) of development in accordance with changing societal values and changing circumstances

The Third Wave Revisited

The preceding sections deal with two topics: first, how STS scholars critique innovation in general and Innovation Studies in particular without clarifying their own normative commitments; second, the normative commitments of RRI and their (non-)reification in the EU. Despite the different foci, the arguments we reconstruct or reproduce in these two sections are both grounded in a co-productionist point of view (e.g., Strand and Spaapen 2021, 50; Pfotenhauer and Juhl 2017, 80; Stilgoe, Owen, and Macnaghten 2013).

The co-productionist strand of STS has been implicated in prior debates regarding normative commitments in STS. In 2002, STS scholars Harry Collins and Robert Evans published the article "The Third Wave of Science Studies" (Collins and Evans 2002), where they argued against dissolving the boundaries between expertise and lay knowledge in technical decision-making. Specifically, they argued for separating technical-scientific input to decision-making from political input. This attempt at developing a normative theory regarding the place of expertise decision-making was met with severe critiques from co-productionist scholars such as Sheila Jasanoff and Brian Wynne. The ensuing debate revolved around questions regarding the limits of participation and deliberation (Jasanoff 2003; Wynne 2007, 2003).

STS scholar Darrin Durant (2011) suggests that the debate surrounding the third wave of science studies revolved around two critiques (ibid., 694). The *contextual* critique (correctly) pointed out that the demarcation of technical and political issues is often the crux of an issue (e.g., Wynne 2007; Jasanoff 2003), thus complicating the sequential process of deliberation and technical decision-making suggested by Collins and Evans. The *normative* critique characterised Collins and Evans' proposal as illiberal and undemocratic (ibid.; Wynne 2003). Despite the fact that Collins and Evans' "theory sometimes indicates more and sometimes less public participation" (Collins and Evans 2002, 271), Jasanoff countered their proposal by asking the following question: "why should we pay attention to work that seems on its face to be looking for principles with which to limit the scope of public participation?" (Jasanoff 2003, 397). Granted, Jasanoff offers a series of potential answers to this question but ultimately concludes that Collins and Evans operate with a false dichotomy between democracy and expertise: "The question is how to integrate the two in disparate contexts so as to achieve a humane and reasoned balance between power and knowledge, between deliberation and analysis" (ibid., 398). How such a balance can be struck is left unanswered. Indeed, the dynamics of this debate points to a tension within STS: calls for deliberation and participation are commonplace, whereas guidance on when to stop deliberating and start making decisions is met with suspicion. However, as Durant (2011, 692) notes, democracy requires deliberation *and* decision-making.

The debate surrounding the third wave of science studies allows us to recontextualise our points regarding the Innovation Studies–STS relationship and the institutionalisation of RRI in the EU. These points revolve around commitments in co-productionist scholarship and can thus be recast as contributions to an existing (though largely dormant) debate regarding normative commitments

in STS. In the next section, we draw on the distinction between formal and substantial principles to bring the nature of this debate into sharper relief.

The Problem of Substantiating Principles

The strong worry of co-option and reification in STS scholars' discussions of RRI, and the claims that STS is characterised by a reflexivity and a constructivist epistemology lacking in both Innovation Studies and existing innovation governance initiatives, suggest a strenuous attitude towards the practical operationalisation of STS ideals. Here we see a situation analogous to what the Norwegian philosopher Hans Skjervheim termed *the liberal dilemma*. Skjervheim articulated this dilemma in a critique of Scandinavian liberalism in the 1960s. As the term suggests, Skjervheim's dilemma is one that arises from liberal ideology, or more precisely, from liberals' reticence to acknowledge that their liberal views necessarily infringe on people's liberties when they are put into practice in a state. The liberal position risks becoming paternalistic, as it says that everyone should be free, albeit within specific boundaries. The liberal dilemma is then that "*when the liberal principles are made absolute, it all transforms into absolute illiberalism*" (Skjervheim 1968, 15, our translation, emphasis in original).[3] This is not to be understood as a wholesale rejection of liberalism on Skjervheim's part, but a criticism of liberals who implicitly assume that they hold a privileged position over and above others, and who fail to reflect on the dilemma and the instances where it might arise. While Skjervheim discusses the principle of freedom specifically, we find it reasonable to assume that similar dilemmas can arise in connection with other ideals, be it democratisation, reflexivity, responsibility, or inclusion. This, we suggest, is because dilemmas of the type in question concern the realisation of abstract ideals and meta-norms.

Skjervheim's reasoning crucially concerns the reification of principles. In the case of liberalism, Skjervheim was concerned with the liberal political principle that people should be free to live their lives as they like, and how this principle cannot be put into practice without also compromising it. Skjervheim's reasoning around the liberal dilemma is based on the distinction between formal and substantial freedom in philosopher G. W. F. Hegel's ([1820] 1970) *Grundlinien der Philosophie des Rechts*:

> The formal freedom or, as it is also often called, the negative freedom, is the freedom that gives each the right to pursue their own private interests. The substantial freedom is on the contrary based on insight into universally valid principles. The task of the substantial state is precisely to

[3] The original Norwegian reads: "*når dei liberale prinsippa vert sette absolutt, forvandlar det heile seg til absolutt illiberalitet.*"

> bring this universality into reality, in other words the state is this bringing into reality, 'der Staat ist die Wirklichkeit der sittlichen Idee.' (Skjervheim 1968, 19, our translation)[4]

Herein lies a contradiction. The liberal state makes the notion that the individual should be able to live its own life freely into a universal principle, thereby grounding individuality in the unity of the state (ibid., 19–20). As the state is "the reality of the moral idea," it imposes restrictions on its own guiding principle, even if this principle is freedom. Skjervheim uses freedom of religion to illustrate this point. While the state might enforce the principle that religion is a private matter, some religious communities might oppose this principle (ibid., 20). Hence, upon being put into practice, the political ideal of freedom of religion infringes upon the beliefs of some religious communities, and thereby also the same communities' freedom to practice their religion. We are faced with the question: how can freedom be made substantial, be made real, without undermining freedom itself? The short answer is that it cannot. The longer answer is that it cannot, but the principle may be approached. While any principle can remain pure as long as it resides in the sphere of ideas, upon being operationalised in the real world—whether in the liberal state or innovation governance—principles come into tension with themselves. The reification of *any* principle also requires specifying how and when to delimit it.

To illustrate our points in the context of innovation we can look to the NSI literature, which in our estimation exhibits a willingness to make substantial commitments. We suggest that the NSI literature, and the mission-oriented innovation literature which is in part built on the NSI perspective, can be seen as committing to a substantial view of the world. This view understands modern society to be developing through a series of techno-economic paradigms, with various nations having various conditions for adapting to and benefit or become harmed from these paradigms. This view sets the stage for substantial normative commitments: according to this view, governments have the responsibility to ensure that innovations foster economic growth, environmental sustainability, and societal stability, through policies that support diffusion of technology and knowledge. This outlook has given Innovation Studies scholars the opportunity to study innovation in a manner which has allowed for providing substantial policy recommendations in specific contexts, from Freeman's looking to Japan in the 1980s (Freeman 1988) to the mission-oriented innovation policies currently being pursued by the EU (European Commission and Mazzucato 2019).

[4] The original Norwegian reads: "Den formale fridomen eller, som det òg ofte vert kalla, den negative fridomen, er den fridomen som gjev ein retten til å forfølgje sine eigne private interesser. Den substansielle fridomen er derimot basert på innsikt i allmenngyldige prinsipp. Den substansielle staten si oppgåve er nettopp å verkeleggjera dette allmenne, eller staten er denne verkeleggjeringa, 'der Staat ist die Wirklichkeit der sittlichen Idee.'"

This is not to say that all forms of Innovation Studies have been beholden to or succeeded in living up to such commitments. We can, however, look to the foundational work of scholars like Freeman to find a framework for substantial commitments going forward, for both Innovation Studies and STS. The kind of substantial commitments we see in the literature on directional mission-oriented innovation policy appear, at least in part, to be made on this basis. One example here is Mazzucato's view on the role of the state in setting direction and translating public values into policy. This arguably entails the reification of a specific form of democratic and public engagement through mission-oriented innovation policies, which also delimits citizens' agency, in order to be able to achieve societal aims. This specific view of democracy and engagement might justifiably be criticised on several grounds. Therein, however, lies its strength compared to second-order norms such as "democratisation" which are impervious to critique (what reasonable person would be against democratisation?), but lack substance and therefore are unable to have effect.

Skjervheim's discussion of the liberal dilemma can help clarify a shortcoming in the STS critiques of Innovation Studies and innovation governance, and thereby highlight a deeper issue in co-productionist approaches to governance or societal change. This shortcoming is connected to the distinction between first- and second-order normative commitments and consists in a lack of recognition of how engagement with real world policy necessitates commitment to determinate substantial values and principles. Through its studies on how technoscientific processes could have turned out differently, STS has traditionally indicated a commitment to reflexivity understood as a second-order norm (as well as other second-order normative principles, such as democratisation). For example, Stilgoe, Owen, and Macnaghten claim:

> . . . second-order normative commitments to democratisation, which we see as vital for the good governance of science and innovation. We support the feasibility and desirability of shaping or steering science and innovation, as opposed to letting the future take care of itself. It is not the purpose of this paper to explore the first order normative question of desirable ends, although we would argue that such a discussion is important. (Stilgoe, Owen, and Macnaghten 2013, 1577)

When norms such as "democratisation" are prescribed as guiding principles for research, they must be made determinate substantial principles. This is not obvious from the distinction between first- and second-order norms. The advantage of the formal/substantial distinction is precisely that it highlights how more abstract norms become substantial commitments as they are mobilised in politics and policy. For instance, the commitment to reflexivity as a meta-norm is bound to fail in practical engagement with the world. A commitment to better science, technology, and innovation, and to democratisation, which does not further specify what this means or how to achieve it (see, e.g., Durant 2011) will still take a substantial form upon being institutionalised.

On these grounds, we suggest that in order to safeguard against co-option, one must recognise the necessity of reifying ideals, and that such reification entails compromising one's commitments. From this perspective, the co-option of RRI appears to result from the reluctance to commit to a substantial principle, which, as Skjervheim indicates, requires specifying limitations and trade-offs. Those developing and institutionalising RRI appear reluctant towards such specification

(e.g., Owen, von Schomberg, and Macnaghten 2021, 223; Strand and Spaapen 2021, 46). However, if STS scholars do not specify how to institutionalise a principle such as responsibility, they are simultaneously unable to stop others from doing so—as exemplified by RRI and the six keys. This represents a challenge regarding the institutionalisation of second-order commitments more broadly: since they cannot be institutionalised in their universal form, one must specify how to delimit them.

The future for RRI might be changing. A quartet of early-career scholars have outlined five possible commitments for future work in RI/RRI, calling for greater pragmatism in changing organisations and institutions from within, rather than "pursuing another idealist vision" (Shanley et al. 2022, 129). This does suggest a step in a direction away from debilitating worry of reification and co-option, and a step towards articulating substantive commitments for RRI. We would point out, however, that the problem is not idealist visions in and of themselves. The problem is rather the reluctance to specify how one's ideals should be delimited in practice. If RRI scholars going forward fail to do this, we believe, there is a considerable chance that they will end up with similar disappointments as those expressed by scholars engaged in Horizon 2020.

STS scholars engaged in innovation need to articulate substantial commitments to avoid co-opting and unwanted reification. These commitments must be tied to some overarching vision of what the world is like now, and how one should conduct oneself. One must also be willing to make necessary delimitations to those commitments in order to make them have an effect in the real world. We suggest three possible approaches, each of which comes with a price:

1. *Commit to existing programmes grounded in substantial principles*. Contemporary mission-oriented innovation policies can be regarded as having made substantial commitments with regards to democracy and participation. STS scholars could commit to mission-oriented innovation policy frameworks as they are operationalised in the EU and various countries. This would also imply working from the worldview which these policies are grounded in.
2. *Develop new programmes grounded in substantial commitments*. This approach requires a descriptive analysis to serve as a starting point, a set of normative commitments relating to the analysis, and a set of principles derived from these commitments. The most obvious example of such an approach is Collins and Evans' (2002) normative theory of expertise; however, the approach we sketch out may be pursued regardless of starting point and normative commitments, as long as the commitments are substantial.
3. *Remain committed to critique and reject substantial commitments*. STS scholars could also refrain from committing to a specific analysis and the accompanying substantial commitments. This approach ensures that STS scholars do not need to compromise on their principles. It does, however, entail a renunciation of their ability to engage with science and innovation governance. (Or, at least, this would entail outside-in critiques of such governance.) This approach would represent a commitment to critique over practical and pragmatic engagement with policy settings.

These three possible approaches are not exhaustive. With regards to innovation, our preference leans towards the second approach as we see it as most promising with regards to being able to build on STS insights, while also engaging with governance. We do not, however, suggest that all of STS must choose one or the other. Rather, we seek to delineate and clarify what kinds of commitment are appropriate in which settings.

Conclusion

STS scholars have expressed admiration for Innovation Studies (e.g., Wyatt 2023), and STS has clearly impacted policymaking—especially in Europe (e.g., Horst 2023; Webster 2007; Irwin 2008; Sørensen and Williams 2002), but also elsewhere (Fujigaki 2009; Winner 2021; Lynch and Cole 2005). Despite—or because of?—this fact, the spectre of co-option haunts STS (e.g., Rip 2016, 292–293; Hackett et al. 2008, 1; Webster 2007, 462; Strand 2019, 58). To investigate the nature of this haunting, we have explored two examples of STS engagement with innovation: STS critiques of Innovation Studies and the institutionalisation of RRI in the European Union. We have argued that these seemingly disparate literatures are in fact both suffering from an overreliance on self-identification with the virtue of "reflexivity." Then, drawing upon Norwegian philosopher Hans Skjervheim, we have proposed an exorcism.

Whereas STS has excelled at showing that it could be otherwise, governance requires it be one way or another.[5] The way forward for STS scholars who want to engage with Innovation Studies and/or innovation governance should not so much be calling for more reflexivity, but rather to address the dilemma of whether to hold on to formal principles, or to engage in policy work which requires compromising on one's principles. Looking to Skjervheim, we suggest that there is an unresolved tension in both the literature wherein STS scholars engage with Innovation Studies, and in the literature where STS scholars reflect on their engagement with innovation governance in RRI. In both literatures, which rely on co-productionist approaches, we find instances where the implicit or explicit commitment to second-order principles, such as reflexivity, are derived *via negativa* through critiques of Innovation Studies and innovation policy practices. This, together with the co-productionist tendency to reject commitment to first-order principles, precludes the ambition for STS to contribute to substantial changes to the governance of innovation. Skjervheim's analysis of the liberal dilemma can be of help here, as it points to a sombre truth: in turning formal principles

[5] Here, there is an affinity between our analysis and the "democracy paradox" articulated by Lövbrand, Pielke, and Beck (2011). They found that although STS has undergone a turn towards deliberative notions of legitimacy and democracy, the field tends to reject objectivist principles for deliberation. The authors urge "scholars of science and society to reflect on and specify what grounds the legitimacy of deliberative governance arrangements are based" (ibid., 490).

into substantial principles, we must necessarily make compromises. It is through such compromises we make the world resemble our ideals a bit more than it otherwise would.

Acknowledgments

We thank Professor Margrethe Aune and Professor Knut Holtan Sørensen for reading and commenting on an early draft of this article. We also thank the CLEEN research group at the Department of Interdisciplinary Studies of Culture (NTNU) where we presented an early version of our argument. In particular, we thank Dr. Outi Pitkänen and Professor Thomas Berker, who served as main commenters.

Conflict of Interest Statement

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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