

Building an Agenda for Socio-Technical Integration Approaches

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Abstract. Collaborative approaches for supporting the consideration of societal and ethical implications and contexts in the ongoing work of research and innovation actors have proliferated throughout the Science and Technologies Studies community over the last 10 years. These developments present an opportunity to develop a common agenda of research. This chapter reports on two recent exercises that brought together socio-technical integration scholars and practitioners in order to scope out and reflect upon what such an agenda might entail. After summarising a handful of recurrent methodological, conceptual and normative themes that were articulated in both exercises, it briefly situates these within the literature and identifies some ‘next steps’ for continued agenda-building.

Keywords. Collaboration, Intervention, Responsible Innovation, Socio-Technical Integration

4.1. Introduction

Collaborative approaches for supporting the consideration of societal and ethical implications and contexts in the ongoing work of research and innovation actors have proliferated throughout the Science and Technologies Studies (STS) community over the last 10 years. This work has gone under a variety of general labels, including socio-technical integration (Fisher *et al.*, 2015), convergence work (Stegmaier, 2009), post-ethical, legal and social implications (ELSI) research (Rabinow and Bennett, 2009) and ethics on the lab floor (Boenink, 2013). Distinct collaborative methods and approaches have also been developed including value sensitive design (Friedman *et al.*, 2013), socio-technical integration research (Fisher and Schuurbiers, 2013), constructive technology assessment (Rip and te Kulve, 2008), crossover research (Nydal *et al.*, 2012) and value levers (Shilton, 2012), to name only a few.

These developments call for an attempt to organise scholars and practitioners from what some see as an emerging scholarly field and to investigate starting points for what could evolve into a common agenda of research. This chapter reports on two such

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recent exercises, one held in Europe and one in North America, that brought together integration scholars and practitioners for the purpose of scoping out and reflecting upon what such an agenda might entail. Accordingly, we summarise some of the findings from a workshop devoted to agenda building for integration approaches and recap some of the questions that emerged from a follow-up roundtable that was meant to reflect further on the idea of such agenda building. It is hoped that readers will see this brief report not so much as one particular vision for what an agenda might look like, but rather as an impetus for a wider discussion and debate around a key set of issues, questions and practical considerations.

As stated, past years have seen the emergence and increasing application of various collaborative approaches to socio-technical integration. By engaging in sustained and/or structured interactions with natural scientists, engineers, and other innovation actors, STS scholars aim to deepen and enhance reflexive awareness of the socio-technical interactions that already take place during research and innovation processes. The increasing number of publications, panels, approaches, and workshops on the subject point to a growing scholarly base for this type of collaborative integration more generally. Beginning in 2013, annual meetings that brought together practitioners of diverse integration approaches were convened in Tempe, Arizona; Kitchener, Ontario; Twente, The Netherlands; and Cardiff, Wales. These and related developments point to a growing network, perhaps even a community of practice, comprised of integration scholars and practitioners.

As an outgrowth of this recent scholarly interest, several comparative studies analyse and attest to the diversity and potency of various approaches for socio-technical integration. For instance, Balmer *et al.* (2015) examine the multiple roles played by integration scholars based on their collective experience in synthetic biology in the United Kingdom (UK); Boenink outlines a family of partially overlapping activities derived from a handful of distinct United States (US) and European approaches (2013); Doorn *et al.* (2013) compare five approaches in terms of phase, level and normative stance, and Fisher *et al.* (2015) develop a framework to compare different collaborative approaches to socio-technical integration, based on a survey of over a dozen approaches and illustrating it with exemplars.

Such comparative studies not only represent what we take to be a growing and lively area of engaged scholarly activity that may be compared with related and overlapping areas of science studies engagement such as public and stakeholder engagement, technology assessment, ethical, legal and social implications/aspects (ELSI/ELSA), they represent opportunities for integration scholars to become more reflexively aware of their own undertakings. Building on this, we suggest to further work on refining, designing and assessing the employment of these approaches within a wide variety of organisational and institutional settings.

This latter point begins to take on additional force when we consider the relatively high degree of authoritative attention that approaches to integration are continuing to receive. Public policy initiatives such as for the ‘responsible development’ of nanotechnology in the US (Bennett and Sarewitz, 2006; Fisher and Mahajan, 2006) and ‘responsible (research and) innovation’ in Europe (Stilgoe *et al.*, 2013; von Schomberg, 2012) provide ongoing opportunities for designing, performing and assessing such interventions—even while they intensify critical questions about the relation of integration scholars to their participants, collaborators, and state sponsors (Hackett,

2014; Felt, 2014; Fisher, 2011). These and related policy developments have, in addition to a good deal of engaged and experimental scholarly research, also enabled program-level activities that incorporate integration (Goorden *et al.*, 2008; Guston, 2014; Viseu and McGuire, 2012; Rodriguez *et al.*, 2013; Rip and van Lente, 2013; Walhout and Konrad, 2015). Although what constitutes desirable and productive forms, modes and outcomes of collaborative integration remain matters of uncertainty and disagreement (Doubleday and Viseu, 2010; Rogers *et al.*, 2012; Stavrianakis *et al.*, 2014), integration approaches continue to be developed and applied across various research and innovation contexts. From a multi-level perspective, integration is showing signs of becoming institutionalised across a broad range of political and geographical contexts (Fisher and Rip, 2013; Rodriguez *et al.*, 2013), which in turn calls for aggregating learning from scholarly, practitioner and programmatic experiences.

Despite the growing body of literature on integration, however, few attempts have been made to articulate a research agenda for the field. Such an exercise can serve the dual purpose of supporting those scholars who have chosen to practically engage in integrative approaches, as well as those interested in the broader questions surrounding the governance of emerging technologies, the division of moral labour, and what it means in practical terms for scientific experts and institutions to be socially inclusive, responsive, and responsible. To this end, and as a preliminary step, we organised two related exercises: a workshop held at the University of Twente in the summer of 2015 and a follow-up roundtable at the S.NET annual meeting that Fall. Both had similar themes of agenda building, which we describe in greater detail below. First, we summarise the workshop findings with respect to what some of the topics and themes that an agenda for socio-technical integration approaches might include; following that, we recap the roundtable reflections on the idea of building such an agenda and how it might be framed and contested. The chapter concludes with reflections on the existing foundations for a research agenda as well as suggestions for putting some of the emergent ideas into practice.

4.2. Workshop exercise: What's next in socio-technical intervention approaches?

Inspired by a decade of interactions between practitioners of the two 'soft interventions' known as socio-technical integration research (STIR) and constructive technology assessment (CTA), which have been largely centred around the two institutions of Arizona State University (ASU) and the University of Twente, respectively. A workshop was held on 22-23 June 2015 at the University of Twente, the Netherlands, as part of a broader set of collaborative activities. Entitled 'What's next in socio-technical intervention approaches?', the workshop brought together scholars practicing 'socio-technical and ethical integration and intervention approaches' in order to facilitate an in-depth exchange and reflection on the specific merits and challenges of different approaches.

The workshop was organised so as to cover a broad range of approaches as well as a number of both practical and theoretical questions. Approaches and considerations were loosely organised in terms of focusing on lab-level and research-project activities such as STIR, on field-level oriented approaches such as forms of CTA, and on

considerations of how these and similar approaches are being and might further be incorporated in research programs such as at ASU and in the Netherlands.

Presenters were invited to openly report on their experiences with particular approaches, to position themselves in the field of socio-technical interventions, to consider their specific merits and limitations, and to share their ideas about ‘construction sites’ and promising avenues. Ample room for discussions and group work was provided.

The following comprises a short summary of a few central themes that emerged during the workshop. While this summary necessarily represents only a sample of the broader discussions that occurred within breakout groups, presentations, and broader group discussions, they tend to be ideas that were articulated repeatedly, that is, by multiple individuals across the different workshop formats just mentioned, and that seem central to grapple with. In line with the ambition of the workshop, these discussions addressed considerations which referred rather to the field of diverse socio-technical integration approaches than to specific variants thereof.

Here, we present three intertwined themes that recurrently arose from attempts to unpack what ‘success’ means for integration approaches, projects and programs. This cluster of themes revolves around questions about the enabling conditions for effective integration, the normative diagnosis that justifies integration, and the impact and assessment of integration endeavours. As one breakout group put it, ‘why exactly is stimulating reflexivity a good thing to pursue and what are conditions for success?’

4.2.1. Enabling conditions

Understanding the conditions, capacities and virtues that enable a given integration approach—and integration activities more generally—to be effective and impactful would be central for building a research agenda, according to workshop participants. Questions about enabling conditions would also need to be tempered by symmetrical questions about the conditions that work against successful and effective integration. The conditions and capacities of integration were recognised to be complex and to involve a mixture of the structural contexts within which specific integration approaches are located; and the methodological strengths and proclivities of a given integration approach; the skills, dispositions and virtues of collaborators and participants, among other factors. Understanding the structural conditions, mappings and grammars for integration openings is important not only for aiding in its effectiveness, but also for interpreting it in light of contemporary cultural and political developments and their historical significance.

4.2.2. Normative diagnosis

In addition to understanding what enables integration, workshop participants identified another key thematic question, namely, what mobilises and justifies effective integration and how such endeavours are framed. For regardless of how well integration approaches are able to pursue their aspirations, from an agenda-building

perspective it is important to bear in mind the more fundamental question of what warrants integration endeavours in the first place.

The workshop sought to gather this work more broadly under the notion of the ‘normative diagnosis’ for integration, and the organisers asked each of the various practitioners to articulate the diagnosis that motivates them. It became clear from the responses that there is an opportunity for such work to draw upon both the (implicit and explicit) moral reasoning that can frame integration approaches as well as the expectations, imaginaries and visions that can constitute them. Additionally, rationales for integration will certainly vary across integration policies, programs, projects and approaches, making for a rich and landscape of contested and competing normative diagnoses. Thus, care is needed when, e.g., distinguishing between the goals of stimulating versus enhancing reflexivity; how reflexivity is related to other goals and commitments such as to democratic values; what ethical and political narratives emerge from integration approaches and programs; and the political implications of adopting particular framings in particular contexts. As some workshop participants put it, ‘what world does your approach envision?’

4.2.3. Measuring impacts

The question of success also led to questions about the conceptual and empirical basis for effective integration as well as the metrics and means for assessing and measuring it. Just as the two themes discussed above are inseparable from one another and need to be considered in tandem, so also is the question of assessing impacts and effects wrapped up in assumptions about the normative basis for and enabling conditions of integration. While some workshop participants noted that the term ‘impact’ implies a one-way deterministic view, we reproduce it here not only because it appeals to more mainstream institutional research policy discourses, but also because using it in the context of socio-technical collaborations does (or should) point to essential tensions that are at the root of precisely these science-society conceptualisations that such collaborations are intended to productively disrupt.

One set of outcomes that workshop participants identified for assessment had to do with whether socio-technical interventions should yield a co-production of knowledge, whether learning should be two-way and, if so, whether it should be expected to lead to a transformation of identities. A related set of questions had to do more with whether the outcomes sought relate more to building consensus or dissensus, and in which cases stabilisation and in which disruption is appropriate. Others focused more on longer-term developments and on the capacities and conditions that were thought to enable more socially robust science and innovation, such as associated with various approaches to the governance of emerging technologies.

Like the question of impacts, the question of measurement was something that emerged in multiple workshop interactions, even if, at the same time, it comes with its own set of problematic yet unavoidable issues. As one of several breakout groups during the first day of the workshop reported,

‘Most of us wondered about the impact of interventions and their evaluation. To make sense of and convince others of the usefulness of sociotechnical integration, evidence of impacts would be helpful. But how to assess such impacts? What

counts as a good impact? And how to prevent narrowing down of outcomes to what is easily measured?’

Participants from multiple groups pointed out that methods developed in other fields—ranging from anthropology, organisational studies to international development and deliberative evaluation—could be of use for developing a common set of resources.

As stated, we offer these select themes as an indication of the kind of scoping that went into the agenda building exercise activities of the workshop. A number of other related and overlapping themes also emerged, including themes pertaining to the modular use of approaches (‘which methods can be expected to produce which impacts?’, ‘could we build more on each other’s work and experiences?’); the skills and capacities that constitute integrative expertise (including contrasting abilities to ‘speak frankly’ and to ‘suspend judgement’); numerous methodological, design, and contextual mapping choices (ranging from the different level of integration and intervention to multi-sectoral attempts institutionalise such activities, e.g., in the university and in business); additional questions of cultural differences (e.g., between the US and Europe, ‘both with regard to the role of the interventionist and the setting in which one intervenes’); and strategies to facilitate more ongoing exchanges among integration and collaboration scholars (including publishing on ‘failed’ attempts).

Rather than elaborate further on the brief summaries above, or on additional themes and questions that would definitely be of interest in a research agenda, we now turn to another set of conversations over the question of how such an agenda might be framed.

4.3. Roundtable exercise: Building an agenda for socio-technical integration approaches

Following the workshop, three of the authors (EF, KK and MB) organised a roundtable that was meant to briefly summarise and reflect on both the workshop findings and revisit the idea of ‘what’s next’ more generally. This was held at S.NET 2015 in Montreal, Canada and constituted a more public venue, with additional variety of integration perspectives and approaches.

At the start of the roundtable, we reiterated the perceived need for agenda-building by briefly discussing a range of approaches that have been developed in socio-technical integration, as well as the current context of policy initiatives and research programs presenting both opportunities and challenges for such integration. Against this background, several participants to the round table then reflected on what could and should be ‘next’ for these integration approaches. Some contributions focused on practical ways to move from specific, usually project-based interventions to more widespread attention for and activities to foster socio-technical integration. The general idea of upscaling activities, however, also raised critical questions about the conditions that need to be in place to be successful. As with our summary of workshop themes, those we present here from the roundtable are only a selection from among broader range of topics, issues and questions.

4.3.1. *Mainstreaming and repertoires*

Inviting participants to consider ways to upscale integration activities beyond the project level, Kornelia Konrad raised the question whether it would be possible to ‘mainstream’ attention for societal and ethical aspects of innovation by developing small scale integration approaches that could be taken over by researchers and other innovation actors involved on the research and development (R&D) work floor. Since permanent heavy involvement of social scientists and humanities scholars throughout research and innovation projects in general was seen by participants as impossible, this might require the development of less demanding, more modest tools and approaches for integrating such reflection in innovation processes and working routines (see also Schulze Greiving *et al.*, this volume). And it would also require (and ultimately contribute to) capacity-building among innovation actors.

Whether or not as part of such mainstreaming, it seems useful anyhow to develop current tools and approaches into a more versatile and comprehensive ‘socio-technical integration repertoire’, in which different tools can be used for different purposes, but also complement each other (where for example a CTA workshop might allow a broader range of actors to take up issues emerging from a STIR study). This line of approach would suggest a need to further develop our understandings of which approaches tend to better suit which purposes and contexts, and how approaches can be tailored towards specific contexts and purposes.

4.3.2. *Longer time frames and capacity building*

Participants at the roundtable, like those in the workshop before, agreed that evaluating impact is crucial, but also challenging. Maybe *because* evaluating impact of socio-technical integration activities is challenging, it seems wise to evaluate interventions more broadly than just on local or short-term impacts. We also should reflect on potential longer-term, aggregated effects of such interventions. If innovation is a process of constant change, we need continuous attention for socio-technical integration as well. Fern Wickson (Genøk-Centre for BioSafety, invited panellist) urged that there is a need to develop long-term visions of what can be achieved, not just a set of activities.

If we aim to change mindsets and routines in innovation processes, however, we should learn under which conditions integration activities contribute to capacity building and/or institutionalisation. As Ulrike Felt (University of Vienna, invited panellist) pointed out, there may be structural factors in science and innovation preventing a more permanent embedding of integration activities. Integration risks becoming a cultural entertainment program: ‘really fun’ to participate in, but not suitable to include in your publications in high-end journals. In a similar vein, it seems easier to integrate attention for ethical and societal issues in technology development, than in research activities. In both cases, the temporal structuring of science may discourage engagement. If those conducting socio-technical integration approaches evaluate more systematically which traces they have left in the people they worked

with, also on the long term, more insight might be gained in where and how we can make a difference. Such insights could be used to shape 'soft infrastructures' that facilitate a lasting impact.

4.3.3. Risks and limitations

Attempts to upscale or mainstream integration activities, several participants warned, are not without risks or limitations. Felt warned that formalisation of integration activities may invite specialisation, implying that such specialisation is not necessarily the best way to go. Wickson, in turn, pointed out that conceptual frameworks may be in need of reconsideration. The use of the 'integration', for example, suggests that scientists/engineers on the one hand and social scientists/humanities scholars on the other each have their own expertise, which need to be integrated. The point of our activities and interventions may not be, however, to bring something new to the others, but to help *illuminate* what is already there. More generally, we need to be aware that integration work is prone to processes of 'othering'. The importance of a critical stance towards the type of questions that are being asked was stressed. Finally, participants pointed out that engagement to stimulate integration should not only take place when invited, but also uninvited!

4.3.4. Roles and responsibilities

Part of the discussion during the roundtable centred on the question how to (re)distribute responsibilities for integrating consideration of societal and ethical issues in research and innovation. Some saw that responsibility for 'values' tends to fall to social science and humanities scholars, but felt uncomfortable with that. A lively discussion ensued how to deal with this risk. Some insisted that integration scholars should refuse such responsibilities; others pointed out that one of the problems of today's innovation system is that nobody takes responsibility. The question is, then, how to *redistribute* responsibilities in such a way that neither technology developers nor social science and humanities scholars feel over-asked.

It was also observed, however, that current methods for socio-technical integration tend to be strong when it comes to diagnosing problems and exchanging considerations, but much less so when it comes to deciding about improvement. Finally, we should not forget that integration is ultimately not about social scientists and humanities scholars, but about including the considerations of stakeholders and citizens. This raises questions about the space for democratic decision making in the R&D process.

4.4. Building on existing foundations

Although additional topics were raised in both the workshop and roundtable formats, we believe that the questions, considerations and themes outlined above can offer productive starting points for additional and perhaps more focused community-based efforts to develop common research efforts and directions as socio-technical integration approaches mature and continue to proliferate. At the same time, they indicate that such

an agenda would in some instances echo ongoing discussions in STS and adjacent fields. As participants in both formats also noted, we believe such an agenda should therefore both situate itself within this broader literature as well as build explicitly upon more recent socio-technical integration scholarship, in order to be truly robust and productive.

For instance, theoretical work on both structural and practical dynamics (e.g., Beck, 1992; Gieryn, 1983; Hess, 2007; Pickering, 2010; Smith *et al.*, 2010) can shed light on efforts to elucidate the conditions under which socio-technical integration already occurs, as a matter of course, and on how collaborative interactions can effectively work within and engage these conditions. A small but growing body of integration scholarship has sought to examine the structural and practical conditions surrounding integration activities from the standpoint of boundary work (Calvert, 2013), infrastructure and identity (Ku, 2013), interactional expertise (Gorman *et al.*, 2013), multi-level dynamics (Rip and te Kulve, 2008), and sociotechnical imaginaries (Richter *et al.*, in review). Similarly, scholarly accounts of integration approaches and experiences can be informed by earlier discussions of intervention (e.g., Zuiderent-Jerak and Jensen, 2007), and mainstreaming of STS (e.g., Rip, 2005).

In terms of normative diagnoses and responsibilities, scholarship on integration has already identified and critiqued normative orientations for integration such as flourishing (Rabinow and Bennett, 2012), care (Viseu, 2015), justice (Ottinger, 2013) and reflexivity (Doubleday, 2007; cf. Lynch, 2000). Recent efforts have also mapped the rationales embodied in integration approaches (Fisher *et al.*, 2015), different types of goal-orientations behind integrative policies (Rodriguez *et al.*, 2013; cf. Stirling, 2005), and the entanglement of normative, interpretive and instrumental roles of engaged STS scholars (Jasanoff, 2011). Indeed, Jasanoff underscores the importance for engaged research activities to operate with an understanding of the historical context and conditions that inform present day policy opportunities and scholarly responses to them.

Regarding methodological commonalities and distinctions among integration approaches, Calvert opens the door to an understanding of collaboration as a research method; while Fisher *et al.* (2015) differentiate collaborative approaches in terms of their orientations towards values and capacities, both their own and those of others, suggesting that attempts to integrate *both* alternative knowledge *and* alternative values into an expert setting are most likely to encounter lasting resistance. Along these lines, at the level of skilful collaboration, Gorman *et al.* (2013) stress the role of interactional expertise in collaborative integration and Balmer *et al.* (2016) identify five 'rules of thumb' for enabling successful integration impacts.

Finally, regarding the outcomes of integration efforts, we note that there are vast bodies of literature on impacts, evaluation and assessment. While there are serious risks for attempts to measure integration outcomes in overly simplistic and reductionist terms, there is already a range of possible effects which are reported or expected from integration scholars, practitioners, participants and sponsors—a range that is quite varied, in substance, scope, and tangibility. Thus, reported outcomes range from different forms of learning (Fisher and Schuurbiens, 2013; Parandian 2012), local adjustments to research projects (Åm and Sørensen, 2015; Fisher, 2007; Flipse *et al.*, 2013; Schuurbiens 2011), strategic insights, and capacity building (Guston, 2014), to eventually broader changes in how research and innovation are conducted. In

particular, socio-technical integration has been closely linked to broader capacity building in frameworks for reflexive governance (Voss *et al.*, 2006), anticipatory governance (Barben *et al.*, 2008) and responsible innovation (Stilgoe *et al.*, 2013).

Here, we sense an opportunity to identify and pursue shared lines of inquiry, for instance with regard to developing theoretical understandings, classifications and justifications for integration impacts and outcomes, both in terms of which impacts integration scholars and practitioners want to strive for as well as which can reasonably be expected from intervention approaches respectively particular types of approaches.

In conjunction with identifying and pursuing new and fruitful directions for scholarship that help inform and contextualise socio-technical integration efforts and activities, we also recommend establishing a comprehensive network for integration scholars and practitioners. Clearly, subsets of such a network are already active, for instance as evidenced by the events reported here; however, broadening and conjoining these existing networks and gatherings into more diverse forums, whether under the ‘communities of integration’ name or otherwise, in addition to establishing online fora, could be valuable for joint support, critique, experimentation, learning and coordinated research and community building efforts.

4.5. Conclusion

This chapter summarises recurrent themes that emerged from an initial workshop and follow-up roundtable, both of which brought together scholars practicing socio-technical and ethics integration and intervention. The purpose of both events was to facilitate reflection on key questions that should jointly inform future directions as the field of socio-technical integration moves forward into new sites of engagement during an era of growing institutional recognition and support. While they shared a number of methodological, conceptual and normative themes, the workshop focused more on underlying diagnosis whereas the roundtable raised questions of responsibilities. Crucial questions remain. For instance, how have scholars differently designed, managed and experienced the relationships between their intervention-oriented activities and their research roles and responsibilities?

Additionally, while we have mostly focused here on an ‘internal’ audience of scholars interested in socio-technical integration, a robust agenda would involve items that also address an ‘external’ audience of R&D actors. Such ‘external’ issues would address questions of scaling, institutionalisation and capacity building within and across the R&D enterprise, including university, government and corporate R&D practices. In the immediate future, we believe that—in addition to more comprehensively networking scholars and practitioners of collaborative integration—more comparative research is needed to gain insights into questions of outcomes and conditions as well as to better familiarise scholars and practitioners with the range of methods, techniques and theoretical starting points that have tended to characterise collaborative integration approaches. Above all, attempts to evolve more effective approaches and promising institutional openings for integration should be balanced with careful attention to the normative and methodological diversity of collaborative approaches as well as to the cultural and historical dimensions of research and innovation contexts with and within which they seek to work.

Acknowledgements

The Twente workshop was supported in part by the Tech4People scholarship 'INTAKE' by the faculty of Behavioural, Management & Social sciences (BMS) at the University of Twente. As organisers of the workshop we would like to thank NanoNextNL and the 3TU Centre for Ethics and Technology for their financial support. The Tech4People scholarship together with National Science Foundation support through the Center for Nanotechnology in Society at Arizona State University (NSF #0937591), supported Fisher as a visiting professor at the University of Twente.

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