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Both critical and applied? Action research and transformative change in the UK water sector

Emma L Westling and Liz Sharp
Urban Studies and Planning, University of Sheffield, UK

Abstract

Social research on water is often critical or applied but rarely both. In this chapter, we share our experiences of negotiating tensions of critical and applied action research through the interdisciplinary and cross-sector UK water research project TWENTY65. By stressing a variety of perspectives, and highlighting the plurality of available options, we argue that action research on water can be constructive, collaborative and yet still critical. However, three key issues of performing action research seeking to support transformative change in technical fields are identified. These issues relate to translation and integrity, applicability, and influence. Despite this, we argue that action research is particularly suitable for working in technical fields because these areas significantly impact upon society and the environment and still are dominated by technocratic decision making with limited democratic or social justice input. Action research in technical areas provides an opportunity for social science to present its perspectives outside of 'normal' social science contexts, supporting greater attention to ethical, justice and environmental concerns. Applying critical action research to water management enables informed dialogue with technical decision makers, raising and pushing forward socially and environmentally progressive futures.

Introduction

This chapter explores the tension inherent to all action research of achieving both applicability and criticality through the case study of TWENTY65 – Tailored Water Solutions for Positive Impact (TWENTY65), a large interdisciplinary UK water research project seeking to support transformative change in the water sector. Such transformative change is seen as required if resilient water services are to be maintained in the face of climate change impacts, population growth, rising environmental standards and changes in consumer behaviours (e.g. ACT Government, 2014; Defra, 2017). Whereas in the past answers to water questions have been seen as lying in the technical domain, utilities and regulators are increasingly recognising that this transformative change will involve social innovation as well or instead of technical change (e.g. Defra 2017; Ofwat, 2017). This shift from a focus on water supply to the promotion environmentally-friendly efficient practices is not only a question of learning better how to communicate; changing practices also involves the re-allocation of costs, risks and responsibilities hence raising issues of governance and

equity. For such implications to be explicit rather than hidden, much greater engagement between the water sector and social science is required (Sharp, 2017).

Research on transformative change in water management is a particularly challenging field for action research to maintain its criticality because many partner practitioners and researchers are drawn from technical sciences and are predominantly positivist in their approach to knowledge. This challenge may be even more extreme in a UK context where water services are delivered by privately owned monopolies whose perspective on social responsibility is developed in the context of their economic regulator Ofwat (The Water Services Regulation Authority). Moreover, as well as researching social transformation wrought by the water industry, the very process of conducting action research may also be seen as itself constituting (or trying to constitute) something of a transformation in drawing attention to social issues and matters of positionality. In all these senses, the case of action research with UK water companies can be seen as an 'extreme case' (Flyvbjerg, 2001) through which the applicability-criticality tension can be explored.

As argued in the introduction of this book, action research approaches that develop actionable knowledge, recognising and strengthening relationships while maintaining a critical voice, are paramount in supporting sustainability transitions. However, such approaches and the knowledge they typically generate may be in tension with what is primarily valued within a historically technocratic and compliance-oriented UK water sector (Speight, 2015). Our focus in this chapter is therefore on how action research in the water sector can be both critical and applied in order to support transformative change and where the key tensions lie. Like the editors of this volume we understand action research as necessarily critical, which involves a commitment to challenge unequal or oppressive power relations, to support social justice and progressive politics, to maintain transparency about our own positionality and to be reflexive over the research process. However, whereas the editors understand action research as necessarily 'relational', here our understanding is only that it achieves the lower bar that it is 'applied'. The descriptors 'relational' and 'applied' both imply a dialogic research process that intervenes in practice; however, in relational research the research subjects are active co-inquirers, whereas this is not necessarily our expectation of applied research. Our understanding of 'action research' as being critical and applied is therefore looser than the understandings of the editors; it encompasses other processes of collaborative social enquiry like 'social learning' (Ison et al., 2013) or 'co-production' (Lövbrand, 2011). To be completely clear, while we agree that action research is ideally relational, we would argue that this relationality might be a hard requirement to meet, perhaps particularly within a field of practice with strong technical research traditions.

Whether relational or applied, practitioners collaborate with researchers to undertake 'action research' use time and energy that is lost from day-to-day activities. Individuals and groups choose to collaborate with researchers because they perceive they have something to gain from the research. All action research therefore needs to be conducted in a way that is mindful of delivering these benefits and maintaining its 'applicability' but this can sometimes be in tension with researchers' desire to be critical.

This chapter draws on the processes of framing and the early development of critical action research within one of the TWENTY65's social science research themes 'Enhancing Water Services through Mobilisation' (Mobilisation). This work involves close interaction with technical colleagues from both academia and from industry. Here, we reflect on this activity, highlighting the tensions we have had to negotiate to maintain action research standards of being both critical and applied. By doing so we explicitly seek to (1) enhance understandings of action research by analysing how criticality and applicability play out in supporting transformative change in the water sector, (2), highlight key areas where criticality and applicability are likely to be in tension in collaborative knowledge production within technical fields (3) provide insights to support action researchers facilitating critical and applied research as part of interdisciplinary and cross-sector projects. In reflecting on how criticality has been sometimes compromised, but also negotiated and maintained, this chapter builds on previous work concerning the role of reflexivity in collaborative research (Westling et al, 2014).

Social research on water

In the field of water management, most existing social research falls into one of two traditions: it is either 'critical' or 'applied', but rarely both. Critical social science has been particularly useful in critiquing water management's current norms and processes. Drawing either on political ecology (e.g. Bakker, 2003; Castro and Heller, 2009; Kaika, 2003; Swyngedouw, 2004) or science and technology studies (e.g. Shove, 2003; Stirling, 2006), this work includes insightful analyses about the contemporary history of water governance within a neoliberal society (Bakker, 2003; Swyngedouw, 2004) offering explorations about how different waters are embedded in and reproduce both a physical and social landscape (Linton and Budds, 2014) and examinations of how policies and technological investments play through to the daily practices of individuals (Shove, 2010). The strength of these critical approaches is that they highlight how different waters are constructed and contested by different stakeholders, stressing the values reproduced, and highlighting the connections between policies and daily practices. A significant critique of these approaches, however, is that they are written from an external 'academic' viewpoint and have little opportunity to impact on policy and practice. Insofar as they are perceived at all, such critical social science is indeed seen as 'critical' by water engineers and practitioners, in the sense that it is *critical of them!* For Shove (2010) this is partly a consequence of current traditions of policy-making that expects that science will provide predictions rather than discussing values and hence seeking to shape daily life through physical and institutional design.

Quite separate from these critical investigations, water management also boasts a long tradition of applied social research, most of which is focused on the management of socio-ecological (e.g. Folke, 2006; Holling, 1978) or socio-technical (e.g. Clarke and Brown, 2003; Sim et al., 2007) systems. This work has done much to stress the importance of working across different stakeholder groups and hence has demonstrated the crucial role of 'the social'

within technical domains. However, while conducted in close contact with practitioners, this work might be argued to be 'uncritical' in the sense that the researchers' positionality is not always made explicit, and the work is often built on an assumption that practitioners and researchers are united around a shared and unambiguous goal. We would also argue that this work is 'applied' but not 'relational', in that it is not necessarily based on a dialogical process of intervening, nor are research subjects usually active co-inquirers in the research.

A small set of work bridges the critical and applied traditions, drawing on critical social science but also working closely with technical practitioners and researchers of water (Browne et al., 2013; Molyneux-Hodgson and Balmer 2014; Pullinger et al., 2013; Westling et al., 2014; Woelfe-Erskine, 2015). Such research builds evidence about the benefits of connecting governance, infrastructural development and everyday practices through a variety of partnerships between the industry and policy makers, advocacy bodies, utility customers and environmental charities. In common with the applied social research discussed above, such work is carried out in close co-operation with practitioners or technical researchers, and hence has real potential to support transformative change in water practices. In terms of their *critical* credentials, all of these works support progressive agendas because they are critiquing and developing environmental aspects of water policy, but doing so in a way that is sensitive to social issues such as gender and equality. But these aspects of criticality are probably true of most social research on water. Crucially for us, however, such approaches also recognise the importance and complexities of partnerships as, for example, requiring time and 'translation' when disciplines, sectors or 'lay' and 'expert' divides are breached (Bos et al*.,* 2015; Browne et al*.,* 2013; Medd and Marvin, 2007), while additionally acknowledging the material and active nature of waters. This research can also therefore be seen to be reflexive in recognising the relational challenges experienced when people with different priorities, expertise and values work together towards mutual understandings, goals and practical outcomes. By encouraging a collective awareness about different values and beliefs, reflexivity has been identified as one route through which some of the difficulties of managing the power dynamics of partnerships such as those between water utilities and publics, or academics and practitioners can be overcome (Lövbrand, 2011; Mackenzie et al., 2012; Phillips et al. 2013; Stirling, 2006; Voß and Bornemann, 2011; Westling et al. 2014). In the environmental governance literature, a reflexive approach to governance requires not only that a range of groups come together, but also that they collectively envision a diversity of alternatives to current action modes and strategies (Beck, 2006) and hence acknowledge that there is no universal solution to a problem (Grin, 2006). By stressing the variety of perspectives and highlighting the plurality of available options, action research on water can (and should!) be conducted in a way that is applicable, collaborative and yet still critical!

In order to further explore these different components of action research and to address the aims of this chapter as defined in the introduction, we draw attention to the negotiations and potential tensions between producing knowledge that is critical and applied in specifically asking: i) How can critical action research influence transformative change in the water sector? ii) What are the main tensions or issues in seeking to influence change underpinned by a critical approach? What is the role of the action researcher in technical research

projects? These questions are discussed through the case of the Mobilisation Research Theme, introduced below.

Case study context

'Mobilisation' is one of two social science led research themes included in the TWENTY65 project. TWENTY65 is a £3.9 million (5 million Euro) research project that seeks to work towards 'clean water for all' in the next 50 years through research to be conducted between 2016 and 2021. Six UK universities and over 70 water-related partners are committed to identifying and developing 'disruptive innovations' that will enable the transformation of the water sector. The project is also truly interdisciplinary including academics from Civil Engineering, Management, Geography, Planning, Mechanical Engineering and Chemical Engineering. Unusually it combines engineering, physical sciences and critical social science.

In the TWENTY65 proposal it was explained that *mobilisation initiatives* 'support water stakeholders in changing their actions in order that collective water services can be delivered more efficiently and/or with reduced impact'. 'Stakeholders' refers, in this instance, to citizens / water users, who are also the companies' customers, who might be mobilised directly or indirectly to change their water practices. For example, dog walkers might be asked to report pollution or fly-tipping instances, residents may be asked to save water, or restaurants may be asked to review their procedures for disposing of waste oil. This distinguishes mobilisation initiatives from participation processes, which stimulate citizens' engagement for the purposes of influencing the water companies' decisions. Of course, many mobilisation initiatives may also involve elements of participation (and vice versa), but in this project a choice was made to focus on initiatives that are primarily concerned with mobilisation.

The context for the mobilisation work package is water organisations' default *technical* response to water challenges. Cultural / behavioural routes to address problems are only considered if the technical solutions do not work. However, in the face of a Victorian pipe system, user disengagement with water, anticipated water scarcity and flood risk from climate change, and population growth, it is recognised that current levels of water services will be hard to deliver in the future through technical solutions, and that the latter will come with a considerable environmental and financial cost. Mobilisation initiatives offer an alternative route to action that might be both more environmentally benign and cheaper. Mobilisation initiatives are already employed in some fields of water management practice – most notably to address water shortages and to deal with issues like Fats, Oil and Grease (FOG) in sewers (Ofwat, 2011). But the limited evidence available about the initiatives suggests that they are of mixed quality and have yielded mixed successes (e.g. Knamiller and Sharp, 2009; Medd and Chappels, 2008; Sharp et al., 2015). Most pertinently, water utilities seeking to develop mobilisation initiatives have nowhere to go for good practice, there is no systemisation or record keeping about when mobilisation is employed and when not, and

there are no standard processes of evaluation for mobilisation initiatives. In this respect mobilisation initiatives contrast strongly with areas of innovative practice in technical fields (for example, regarding leak detection) in which innovations are developed with researchers and data gathering about their efficacy is a high priority.

The overall aims of the Mobilisation Research Theme are to increase the quality of **all** water mobilisation initiatives to be as good as today's best, to broaden the scope of areas in which mobilisation is considered and to ensure that the evaluation of initiatives becomes standard practice enabling learning across the board. These ambitions are to be achieved through mapping the nature and extent of mobilisation initiatives, and by using case studies to explore ideas about 'good practice' in this field. The fact mobilisation initiatives have not been 'mapped' before is because the framing of 'mobilisation' as one set of related initiatives is new. By mapping water mobilisations we are pointing out that the practices of mobilising publics to (variously and for example) save water, dispose of FOG responsibly or report pollution incidents are not so different. Through this research, we expect to not only identify and connect the individuals undertaking this work, but also to empower them to raise questions within their organisation about the choices made in relation to when and whether mobilisation is considered as an appropriate means of action. In terms of best practice, we expect to raise questions about what constitutes effective mobilisation, in particular, examining whether mobilisation contributes to a change in service levels and for whom, and whether environmental or social inequality is challenged or reinforced through the changes.

In order to contribute to these debates, in combination with the TWENTY65 project's collaborative nature and commitment to transforming water practice, an action research approach was adopted. Although our definition of action research is 'looser' than that of the editors, it still enables and supports the 'Mobilisation' research that develops theory to examine practical action with practitioners, to produce critical and applied knowledge (Reason and Bradbury 2008, p. 1). In addition, by using a research project as the starting point, we offer a different aspect of action research, which often focuses on researchers working with practitioners 'in the field' to co-produce knowledge. Although water practitioners are involved in the research project, the analysis in this chapter primarily considers the negotiations taking place between researchers from different academic disciplines within TWENTY65. These technical researchers are our co-inquirers, and co-ordinate the interaction of the whole project with water practitioners; as critical social scientists developing and maintaining validation and support from technical researchers is an important first step to transforming the water sector more broadly. To address the questions initiated in the introduction, the analysis below draws on the processes of bid design as well as negotiations currently taking place at the project's Management Board Meetings (four times a year involving academics to discuss Research Themes progress), and associated Research Theme update meetings with the TWENTY65's Project Manager, Leadership Board Meetings (twice a year involving Water Industry leaders, their consultants, UK water partnerships representatives) and the Strategic Board Meetings (once a year, involving leaders from non-water utilities (e.g. waste sector) and regulators). Negotiations analysed in this chapter also extend to those taken place in the planning and performing of TWENTY65

events, such as the Annual Water Conference and Thought Leadership Club meetings (TLCs), both processes supporting the wider generation of research ideas and efforts to address water's grand challenges. In addition, one of the authors is part of the TWENTY65 'Hub' that meets weekly and co-ordinates a series of interactive meetings (e.g. TLCs and the Annual Conference) developing and bringing forward a research agenda, through which (it is hoped) further disruptive innovations can be identified, developed and funded. In the next section, three key issues from our experience in the Mobilisation Research Theme in seeking to produce critical and applied knowledge that supports transformative change in the water sector is identified and discussed.

Three challenges for action research on water

Issues of translation and integrity

As critical social scientists, we are constantly asked to simplify our research process or outcomes (in particular our language) sometimes to the point where our messages are changed. Such problems are common in interdisciplinary science or engineering led projects where social science often is assumed to take the same form as or fit into more positivist framings of knowledge (Pohl, 2005; Popa et al., 2015) In our case, the term 'mobilisation' has for example caused difficulties amongst engineering academics and project partners. Project partners were not used to the concept in relation to public and customer engagement and would rather see us talking about engagement or participation. However, 'mobilisation' was chosen because it refers to a particular type of initiatives, which, as explained earlier, seek to influence public practices, rather than, for example, collecting public views about water services to influence the practices of the water provider. Despite the clear contribution that mobilisation can make to the TWENTY65 goal of achieving 'clean water for all' it was decided centrally to change the terminology referring to this theme on the website. Perhaps due to the challenge of explaining the difference between mobilisation and participation, the Mobilisation Research Theme is now defined as *'Understanding the potential for public engagement to improve water services'*. While this terminology *might* be accurately interpreted to mean 'mobilisation' initiatives, it is more likely to be loosely understood to include public participation as well as mobilisation. While the website's detailed description does include a definition about mobilisation, it is nevertheless the case that decisions about how the TWENTY65 project headlines the Mobilisation Research Theme should include considerations of what those undertaking this specific research want to communicate. For us, the definition and 'creation' of 'mobilisation' offers new ways of understanding public engagement in the water sector and hence is a central part of our contribution to knowledge. Simply interchanging the term with a concept with a different meaning (in this case engagement) downgrades our knowledge. This is not a simple matter. What is the appropriate balance between something that can be easily understood by partners, and something that incorporates social science language and hence requires partners to engage with our research

at a different level? This dilemma is indeed present in the Mobilisation Research Theme, but it is also one that the project as a whole constantly needs to comes to terms with. Hence, it is important for researchers to balance the need for integrity with being collaborative and mindful of partners' potential limited experience of their field of expertise. It is noteworthy, moreover, that being aware and mindful of the potential confusion that could arise from our communicated messages also encourages us to consider language and concepts very carefully, which has the potential to sharpen and clarify the purpose of our research to others but also to ourselves.

Issues of integrity extend beyond language and also include the process and outcomes of critical research that are often at risk of being compromised. Our technical research colleagues and the different project advisory boards are likely to look for immediate evidence of 'activity' in terms of data collection and in delivering 'evidence' about mobilisations. For example, when presenting at the project Leadership Board meeting that convenes twice a year and includes representatives from the UK water industry, their consultants and water partnerships, one attendee highlighted the lack of £-signs assigned to demonstrate the value of mobilisation initiatives. This comment clearly undermined the importance of the research theme, suggesting that its impact was not seen as useful if it could not be directly integrated to UK water utilities' business plans by for example demonstrating reduced costs for water companies through changing public water practices (e.g. reduced water consumption compared to costs involved in building another reservoir to meet demand). The implication was that monetary costs would be more useful knowledge than an analysis of how water utilities currently work with publics to support transformative change in the water services. Countering this perspective involved stressing the highly context-dependent nature of any monetary evaluations of policy options (while also being aware that cost-benefit analysis was neither our interest nor our expertise). Our experiences here are far from unique but do align with policy-making traditions expecting single objective answers (e.g. Shove, 2010; Stirling 2010). This example also illustrates how there is a constant balance to be found in terms of when to deliver and what to deliver, and when to intervene or let things pass. A similar dilemma has been reported by Stirling (2010) in relation to providing policy advice that is plural and conditional rather than presenting single definitive recommendations more commonly adopted in policy. In Stirling's case however, the negative comments were not necessarily communicated by the policy maker herself, who turned out to be quite enthusiastic, but the people around her. This situation highlights that there may be interpretations made by others or even ourselves about what 'type' of science is likely to be seen as legitimate or applicable and how it should be presented, which may not always turn out to be accurate in practice. Hence, we would argue that staying true to your own research and how it is conducted, and at the same time being clear about how it can be useful in practice and contribute to change becomes crucial for action research to have an impact.

In relation to the Mobilisation Research Theme, criticality is maintained through the use of existing social science literature to systematically develop new and different modes of practice that could transform elements of social life with potentially positive and progressive social outcomes. It also seeks to be critical because its investigation explores and reveals the

implicit values in the way the mobilisation initiatives are developed and implemented and enables debate about the nature of best practice. Further, criticality plays an important role not least when it comes to evaluation of mobilisation initiatives. A particular concern at present is that because of the complete lack of knowledge of such initiatives, existing evaluation processes are focused on achieving instrumental goals, e.g. funding for the next initiative. While such evaluations are often necessary, more comparative data and reflexive input from practitioners could provide a more effective basis for co-creating knowledge about water mobilisation that is both critical and relational.

Further, in terms of maintaining our criticality within the project, it will also be important to make progress on the broader networking aspirations of the Research Theme. One response has been to develop a strategic network of social science researchers of water that had its first meeting immediately following the TWENTY65 Annual Conference in April 2017 with the second planned for April 2018. The aim of the first workshop was to address the questions "What does social science currently bring to the discussion about water challenges?" and "What could social science offer that has not been there?" The workshop concluded that 'Collaborative Interpretive Research on Water" has an important emergent role helping water utilities to design and manage their ongoing dialogues with their publics. Such a network of critical social scientists would also have an important role in pushing forward the transformation of the water sector to become more welcoming to critical social science knowledge and expertise, and hence contribute to a more environmentally and socially progressive set of water services.

An important aspect to highlight in relation to research integrity is that many of the social scientists and engineers in TWENTY65 have collaborated before and the project ideas in the bid came from an established interdisciplinary water centre (Sheffield Water Centre). Established trust therefore eased the negotiation of process and outcomes for the project. In addition, the relationships within the group may help 'sell' critical social science to (sometimes) unreceptive water practitioners and policy makers. If engineering academics that are highly respected amongst water practitioners openly support social science, it adds credibility to our knowledge and expertise. In addition, the water sector's increasing recognition of the importance of working in partnership with publics to address water related challenges (e.g. Ofwat, 2017) has led many individuals working on water services to express commitment to social agendas, including addressing issues of inequality. Indeed, it is clear that those seeking to work with the Mobilisation Research Theme from water utilities are committed to promoting mobilisation as means to socially and environmentally progressive actions. Having confidence that the people you are working with share your values certainly provides a level of comfort and trust that makes it possible to conduct the research effectively as well as maintaining relationships.

Issues of applicability

The second challenge concerns the applicability component of our research and action research in general, and expands beyond the immediate project and project partners to include departmental colleagues and wider social science research. Mobilisation might be seen as something of a 'Trojan horse' for critical social science and in producing knowledge that seek to be both critical, applied and to some extent relational, we need to constantly justify how the design, process and outcomes of the research is influenced, on the one hand by our critical stance, and on the other, by its applied or relational ambitions. Within the Department of Urban Studies and Planning, for example, criticality and a commitment to social justice are highly esteemed. Reviews on draft research outputs stress the need for theoretical inputs to be clear and for critical messages to be honed and focused. Showing these colleagues the more applied and relational aspects of our research where knowledge is co-produced with practitioners could risk being viewed as having compromised our 'external' critical role as researchers. However, theorizing or conducting analysis about certain phenomena is also a form of acting and intervening in the collaborative process that holds normative commitments to how participation (in our case mobilisation) should be performed (Chilvers and Kearne, 2016:281). So, theorizing too inevitably intervenes in the 'cycles of world making' (Jasanoff, 2004:12). By offering something that the water companies genuinely regard as useful while maintaining a critical voice, we argue that social science's seat at the water management research table is more fully secured.

The focus on mobilisation means we are concerned with initiatives that 'ask' publics to act to improve water services. Such initiatives would be critiqued from a political ecology perspective as potentially manipulating the public to undertake work that should be provided by the state (or the utility under the oversight of the state). A concern might be that what begins as a voluntary initiative has the potential to 'creep' into the mainstream, and services that were once provided by the state are delegated to 'community', and service levels then vary according to people's willingness and ability to volunteer or pay. Though we have some sympathy with the critique, it is not useful to apply such a comment in a sweeping way across water services. The critique certainly raises important 'critical' research questions that need to be investigated in the process of examining mobilisation initiatives including who initiates, who is invited, who benefits, and who is responsible for ensuring change happens? However, investigating these questions is a different position from making judgements about the inherent nature of all mobilisation initiatives. We consider such generalisation inappropriate because although these initiatives may not have been used systematically to date, if developed with a caring ethos, we believe that these initiatives have the potential to provide a more socially aware and cheaper water service that reduces environmental impacts and hence delivers value to everyone. In addition, it is not useful to view water management as a zero-sum game. For example, both households and utilities can take action to waste less water. Transformative change to address complex sustainability issues takes place at both structural and individual levels (Whitmarsh, 2010) and hence it is not a question of needing action by one party or the other: we need action by both. Through critical social science being in

dialogue with technical water research and practice (rather than isolated from), opportunities arise to highlight and critique the social justice implications that research and practice protagonists assume to be sustainable. In this light, critical action research could be crucial in supporting transformative change contributing to a more environmentally and socially progressive water sector.

Issues of influence

For action research to influence transformative change in the water sector, there is an issue of integration. In other words, how to move from critical social science being acknowledged as important to being acted upon in policy and practice. In the UK water sector, it is increasingly recognised that social science holds an important place in influencing water management and other technical fields, as demonstrated through the discussion of engagement in government policies (e.g. Defra, 2016,) and regulation (e.g Ofwat 2016a; 2016b, 2017) but also in terms of research funding agendas. It is for example widely understood that the grand challenges of water require the physical and engineering sciences to collaborate with wider expertise, including social sciences (e.g. Sofoulis, 2015). The UK Engineering and Physical Sciences Research Council (EPSRC) that awarded funding to the TWENTY65 project hence required that social sciences formed a part of the proposal, which resulted in two out of eight Research Themes being social science led. However, less acknowledged in these forums are the likely challenges faced when producing knowledge underpinned by different ontologies (Connelly and Anderson, 2007; Sofoulis, 2015) and when generating outcomes of value for a range of actors including academics (e.g. engineers and social scientists), practitioners and policy makers. In the case of the TWENTY65 project, it was initiated by the Sheffield Water Centre (SWC), an interdisciplinary research network with a core of research on urban water issues. Although bringing together people from a range of academic disciplines (including engineering and social sciences) the group has been awarded significant funding over the last 15 years from EPSRC, and the critical mass of expertise in the group have engineering backgrounds, including the Principal Investigator of TWENTY65. In this respect, the TWENTY65 project is an example of where social science is included and recognised as an important part of a project, but the overall project lead comes from engineering which has implications for how knowledge is interpreted and valued. For example, when demonstrating important outcomes from the project to wider partners, technical solutions tend to dominate.

On the other hand, the TWENTY65 project itself and its first Annual Conference held in April 2017 provides an example of the increasing attention to social science in the water sector. The conference was a two-day event seeking to bring the water sector together including different academic disciplines, and water related organisations. In total, 142 people attended the conference of which 56 were academics and 86, policy makers, practitioners, or from SMEs / the voluntary sector. The second conference day's plenary (The role of public engagement in Water Management) and associated discussions were dedicated to social

science, while 'social' conference sessions were also available through the rest of the day. The fact that other project members agreed to allocate a full half day plenary session to social 'solutions' indicates a shift away from purely technocratic solutions to water management, historically dominating the field, to a more socially aware sector which appreciates the importance of contributions from social science in order to deliver 'clean water for all'. The socially orientated keynotes and conference sessions caused lively debates and were also those most appreciated by the conference attendees expressed through the post conference evaluation survey. According to the TWENTY65 Project Manager, the significant social science content of the conference was the one thing that made the conference unique and strongly contributed to the conference success. The TWENTY65 conference brought the water sector together through including different sectors, but more importantly perhaps, it provided a unique space for discussing or at least starting to highlight the challenges of how to integrate critical social science into water management. For example, in the Plenary Session on 'The role of public engagement in Water Management' the discussant Zoe Sofoulis (2017) highlighted the frustration of, that although social science is recognised as crucial in order to deliver a sustainable and resilient water service, such research is not underpinning innovation in water management. This issue relates to the broader tension of why social scientists (or critical action researchers) are rarely included in water decision making given the increased pressure from regulators for water utilities to work with, influence and understand their publics. How critical and relational action research could aid water management and therefore provide practical outcomes becomes a central question. Or in relation to Shove's (2010) point about policymaking being more modest about what it can do and more aware of what it produces, how could water decision-making evolve to be ready for influences from critical approaches to knowledge?

In order to begin to address these issues, an important starting point for the Mobilisation Research Theme, would be to identify and team up with practitioners and policy makers that are passionate about a more socially orientated water future, and through those networks promote change. We already have contact with a series of individuals who might be viewed as 'engagement champions' in the water sector: senior members of staff in water companies or consultancies who are committed to the use of mobilisation and participation initiatives as part of the delivery of sustainable and equitable water services. Added to these senior staff, the key informants for our Mobilisation research are practitioners employed as community engagers and change-makers within the water industry. It should be noted that at present this set of workers is not organised together and is relatively less engaged with water research than their technical equivalents, probably because of the technical emphasis of most water research to date. Though not all will be trained in social science, the activities of these enablers mean that they are already supportive of an agenda concerned with the more attention to public needs and perspectives in water practices. Providing crucial contacts and sources of information for the Mobilisation Research Theme, effectively they constitute a core and growing constituency of on-the-ground workers and demonstrators of water-related community engagement, who may in the future rise to take on senior roles. By understanding these workers, but also training/supporting them, by drawing them into research and by making their work more visible through publications, the Mobilisation Research Theme has

the potential to help constitute and build a new practitioner community, and hence to aid the integration of social perspectives more fully into water practices. Furthermore, by building networks among other critical social researchers of water such support can increase in quantity and depth. In the future an increased volume of water-related action research, particularly research that is able to be genuinely 'relational' working with practitioners to develop and implement innovative mobilisation initiatives, has the potential to help build the identity and confidence of the social practitioners of water, and hence support the sector's wider transformation.

Conclusion

This chapter has enhanced understandings of action research in technical fields by illustrating how criticality and applicability play out in the interdisciplinary research project TWENTY65 which seeks to support transformative change in the water sector. Specifically, we have highlighted three areas of tension between these goals. First, issues of translation and integrity concern how social science research is presented and discussed. Our experience stresses the need to negotiate and compromise, remaining attentive to the way that terminology will be heard and understood, while also maintaining the need to challenge boundaries. Second, under the 'issue of applicability' we explained how we selected a research topic that would secure social sciences' seat at the research table, while still allowing critical action research to be carried out. The broader lesson here is the need to respond to current issues and concerns within the technical field, but to utilise theory and reflexivity to maintain a critical perspective. Third, under the subtitle 'issues of influence' we have discussed the processes of moving beyond recognition of social research to the utilisation of social knowledge within the technical field. Here, we argued the need for critical action researchers to cultivate allies both within research and with practice.

As is apparent, our identification of these issues does not mean that we believe that such projects should be abandoned. On the contrary, we have argued that critical action research is particularly suitable for working in technical fields such as water management that involve environmental and infrastructure governance (other examples may include energy, housing and transport). This is because these fields have a significant impact on our social lives and our environment, and yet are dominated by technocratic decision making and have very limited democratic or social justice input. Water users' marginal involvement in decision-making about the water sector's regulation, priorities and future aims, together with their psychological distance from the centralised water supply and disposal systems which many have come to take for granted, is an equally serious issue threatening the water sector's sustainability as the deteriorating infrastructure and climate change that are so frequently highlighted.

While there is existing critical social science exploring these fields, it tends to operate from outside the area of practice and not work in conjunction with practitioners and scientists

grappling with contemporary challenges. This is not surprising given the contrasting ontologies between the fields (Sofoulis, 2015). Critical action research projects hence provide a crucial opportunity to present social science perspectives and arguments outside the 'normal' context for social science, supporting greater attention to ethical, justice and environmental concerns within water management. As is illustrated by the TWENTY65 example, a significant and useful route for such critical action research is through collaborative research projects with engineering/natural scientists, also intent on transformative change. Crucially, we would argue that it is only through critical and applied action research that more socially sensitive perspectives associated with critical social science can enter into dialogue with technical decision makers and innovators to push forward more socially and environmentally progressive futures.

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