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From invisibility to impact: Recognising the scientific and societal relevance of interdisciplinary sustainability research

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ABSTRACT

Academics are increasingly expected to produce concrete and directly applicable solutions to hard-to-solve ‘real-world problems’ such as poverty, development, and environmental degradation. However, conventional assessments of the impact of science on society have not yet been adequately adapted to capture the diverse effects of this type of problem-centred research. Drawing on a case study of a large-scale project on (un)sustainable consumption, this paper demonstrates the range, complexity and potential long-term nature of impact in interdisciplinary sustainability research. It thus supports arguments for alternative approaches to impact assessment that question conventional views of translating scientific knowledge into action, value the multi-directionality of science-society relations and recognise diverse forms of engagement between scientists and non-scientific actors through non-academic channels and outputs. The paper also challenges common (mis)conceptions of work practices in a university context by demonstrating the highly innovative and inclusive nature of much sustainability research that seeks to address the needs of diverse communities of actors. It is argued that only radically different ways of conceptualising and measuring short-, medium- and long-term impacts can capture the success or otherwise of social-scientific and interdisciplinary sustainability research.

1. Introduction

Pressure is mounting on many academics to produce societally relevant and ‘usable’ knowledge and to actively engage with non-academic actors who are looking for answers to major global challenges such as poverty, development, and environmental degradation (Fischer-Kowalski and Swilling, 2011; Khoo, 2013; Fahy and Rau, 2013b; Clark et al., 2016). For example, those engaged in social-scientific and interdisciplinary sustainability research are frequently tasked with the development and dissemination of concrete, politically acceptable and directly implementable solutions to pressing socio-environmental problems, including growing overconsumption of natural resources, or the unequal distribution of environmental risks globally (Schäfer et al., 2010; Pape et al., 2011; Blättel-Mink et al., 2013; Kirchhoff et al., 2013; Russell-Smith et al., 2015; Defila and Di Giulio, 2016; McNie et al., 2016; Lorek and Spangenberg, 2014). The desire to enhance the relevance of research and to demonstrate ‘value for money’ is also reflected in the growing number of public and private funding bodies whose financial support for research projects comes with more or less concrete stipulations concerning the evaluation of their impact on science and society. For example, the European Commission’s (2006)

White Paper on Communication outlined how scientists have a duty to share their new-found knowledge with a broader public, and that this needs to be prioritised both during projects and as part of subsequent impact assessment.

While this emphasis on ‘research that matters’ has proven beneficial in some respects, major drawbacks have also emerged that merit closer scrutiny. For instance, the increasing marginalisation of basic research or ‘research for research’s sake’ that may or may not have any direct applications has been criticised. Similarly, an extensive and increasingly protracted debate is underway concerning how different science, arts and humanities subjects contribute in very diverse and sometimes contradictory ways to the development of society, and how this diversity cannot be adequately captured through economic impact assessments that disproportionately benefit the STEM subjects. For example, Belfiore (2015) calls upon arts and humanities scholars ‘to resist the economic doxa, and to reclaim and reinvent the impact agenda as a route towards the establishment of new public humanities’ (p.95). The increasingly applied nature of much sustainability research has also raised questions about how to define and measure its societal impact. Growing scepticism among those who view the introduction of impact assessment as a sign of the expanding influence of exclusively economic

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concerns and new public management in academia has fuelled this discourse (Waitere et al., 2011; Belfiore, 2015).

Expectations concerning the exchange of knowledge between science and policy, including through knowledge coproduction (Clark et al., 2016), also closely relate to issues of ‘impact’ and its measurement. For example, while policy-makers often need to find solutions to particular issues (solutions that fit into problem-centred ‘policy narratives’), researchers strive for scientific excellence in ways that are not necessarily measured by real-world impact (Walter et al., 2007; Sedlacko et al., 2013). The main purpose of this paper is to critically reflect on what constitutes impact in social-scientific and interdisciplinary sustainability research, and how it can be meaningfully measured¹. Drawing on the authors’ experiences of working on a large-scale interdisciplinary study – CONSENSUS: *consumption, environment and sustainability* –, it examines opportunities and challenges of undertaking innovative policy-relevant sustainability research within the context of an evolving reward system for societal impact that remains firmly focused on narrow conceptions of ‘transferring’ scientific knowledge into society.

The remainder of the paper is divided into five sections. Section 2 captures existing work, and reviews key findings in the literature that relate to working at the science-policy interface and that critically examine the concept of impact. This is followed by a description of the methodology used, combined with details of the CONSENSUS research project (Section 3). Within the results section (Section 4), particular attention is paid to the impact of CONSENSUS on: (1) local and national activities in sustainability/sustainable consumption research; (2) international sustainability research agendas and activities; and (3) sustainability policy and practice. Section 5 critically discusses the scope, quality and measurability of the impact of CONSENSUS, especially regarding the sustainability policy landscape in Ireland. Finally, Section 6 presents a succinct conclusion and some concrete proposals for enhancing the capacity and quality of research-policy-practice exchanges.

2. Sustainability research on the edge: working at the science-policy-practice interface

A marked shift has occurred in both public discourse and research funding towards ‘policy-relevant research’ that provides usable knowledge to tackle societal challenges, including shifting economic and social development towards greater sustainability (Gibbons et al., 1994; Hessels and Van Lente, 2008; Miller et al., 2014; Woods and Gardner, 2011). Notable efforts have thus been made to foster closer links between those who produce scientific knowledge and those who are expected to use it, recrafting traditional science-society linkages in the process. On a conceptual level, the question of what constitutes useful and usable knowledge has received considerable attention. For example, Nowotny (2003) calls for the production of ‘socially robust knowledge’ by establishing a ‘regime of pluralistic expertise’ that involves diverse scientific and non-scientific actors in the creation and application of knowledge. Some authors have described this as a radical change in knowledge production from ‘Mode 1’ or ‘normal’ science towards ‘Mode 2’ or ‘post-normal’ science (Funtowicz and Ravetz, 1993; Gibbons et al., 1994; Hessels and Van Lente, 2008; Kirchhoff et al., 2013). Here, Mode 1 is defined as academic, disciplinary, homogeneous, autonomous and subject to traditional quality control. In contrast, Mode 2 is expected to be transdisciplinary, heterogeneous, reflexive and socially accountable, subject to novel forms of quality control, and generated in a context of application (Hessels and Van Lente, 2008).

On a more practical level, advocates of inter- and transdisciplinary

research have attempted to reduce the gap between science and society (Nowotny et al., 2001; Hirsch-Hadorn et al., 2008; Spaargaren, 2011; Blättel-Mink et al., 2013; Brandt et al., 2013; Pahl-Wostl et al., 2013; Rau and Fahy, 2013; Di Giulio et al., 2014; Defila and Di Giulio, 2016; McNie et al., 2016). According to Kerhoff and Lebel (2006), relationships between scientific knowledge and action constitute ‘arenas of shared responsibility, embedded within larger systems of power and knowledge’ (p. 473), with significant implications for research design. Kirchhoff et al. (2013) present a fourfold typology of users in decision-making roles – early adopters, tentative and proactive users and laggards – as a potential tool for enhancing knowledge-to-action flows in the area of climate information. Finally, transdisciplinary research initiatives led by so-called ‘pracademics’, that is, practitioners-turned-academics (or vice versa), represent concrete efforts to enhance and redirect science-society exchanges (e.g. Shiva, 2002; McKibben, 2007).²

The growing popularity of transdisciplinary sustainability research that involves both scientific and non-scientific actors in the design and implementation of projects has been driven from different angles, including by key actors that shape the institutional context of academic research (Wiek et al., 2012). Funding agencies increasingly favour transdisciplinary projects, and many government agencies ‘outsource’ policy-driven research because it is more flexible and efficient than recruiting and maintaining their own staff. At the same time, academic institutions and their academic staff are facing growing pressure to secure external funding, with the monetary value of research grants now serving as a key metric of academic assessment and achievement (cf. Slaughter and Leslie’s (1997) critique of these manifestations of ‘academic capitalism’). These conditions have created an institutional and financial environment conducive to the rapid expansion of applied, ‘policy-relevant’ research in the sustainability field and beyond.

Aside from these more critical observations, transdisciplinary sustainability research is gaining traction because of its potential to address complex and ostensibly controversial socio-ecological issues (Shove, 2004; Defila and Di Giulio, 2016). Although time consuming and resource intensive, involving different groups of participants in the research process facilitates the (co)production of knowledge at the appropriate spatial (e.g. local, global) and temporal scales (e.g. for immediate or future use) (McNie, 2007; Schönhart et al., 2009) in ways that incorporate their diverse interests (cf. Blättel-Mink et al., 2013 for an illustrative example from Germany). Furthermore, the inclusion of both experiential and academic knowledge increases the likelihood that research findings are relevant and accessible for diverse audiences, which enhances their societal impact (Mårtensson and Mårtensson, 2007; Jaeger-Erben et al., 2015).

Yet, despite the reported benefits of advancing transdisciplinary ‘Mode 2’ knowledge production, many scientists remain reluctant to do so. The reasons for this are manifold, including existing practices within epistemic communities that are hard to shift, a lack of reward systems for academics to engage in applied, policy-relevant research, and a lack of prestige associated with such work. For example, prominent incentive structures associated with the increasingly ‘career driven’ nature of academic work equate publications in peer-reviewed journals with scientific impact (Wiek et al., 2012). This is problematic given that academic papers are often inaccessible to wider audiences and that non-academics need different forms of communication and dissemination (e.g. participatory workshops, public outreach activities) that may not fit within established work practices in a university context (Di Giulio et al., 2014). Also, academics may be hesitant to change their publication practices if they feel that the effects of alternative communication and dissemination measures either remain invisible or continue to be treated as less valuable by those in charge of management

¹ Throughout the paper we use the term ‘impact’ to capture different forms of societal impact. Whenever we talk about scientific impact (e.g. citations, impact factors), this is stated explicitly.

² Note that a commitment to ‘pracademia’ remains relatively rare among sustainability scientists, partly because of the persistence of rather traditional ‘Mode 1’ notions of science that treat any (open) political involvement by scientists with considerable scepticism.

and promotions.

Another barrier relates to the level of upskilling that is needed to communicate effectively with diverse audiences. For example, the decision to address audiences with different skill sets and degrees of engagement can create tensions over terminology, presentation of results, or the choice of media used to publicise data, whose management requires effective moderation and facilitation skills (Mårtensson et al., 2016). Similarly, efforts to coproduce knowledge by bringing together scientific and non-scientific experts can throw up considerable conceptual, epistemic and practical challenges that require careful moderation. However, few academics have received adequate training to moderate potentially conflict-laden group processes.

Interestingly, attempts to reach diverse audiences place considerable demands not only on researchers but also on those who wish to use research output. However, an almost exclusive focus on scientists improving their communication and dissemination efforts frequently eclipses the central role of users of scientific knowledge in seeking, accessing and interpreting information, the skills required to do so, and potential changes in how non-scientific audiences view and engage with science (McNie, 2007; McNie et al., 2016). For example, national funding agencies such as the Environmental Protection Agency in Ireland (EPA, 2011) increasingly ask for short synthesis reports and practitioners' guides or policy briefs, in addition to the traditional extended end-of project reports, to meet the needs of time-poor policy-makers. This perspective reflects a rather uncritical acceptance of the apparent realities of policy-making within Western democracies where too little time is allocated to the thorough assessment of state-of-the-art scientific evidence, and where the idea of integrated, evidence-based policy frequently remains a mere aspiration (Sedlacko et al., 2013; Russell-Smith et al., 2015). Here, a more fruitful exercise would be to identify social, cultural and political barriers to the use of research findings in politics and practice and to devise initiatives to enhance the uptake of scientific evidence by policy-makers and diverse publics. By putting issues of (political) power into clear focus, these efforts would also help to challenge simplistic 'information deficit models' that are frequently used to explain why policy-makers and other societal actors do not act upon scientific evidence (cf. Fox and Rau (2017) for some critical reflections on this issue in the context of climate change policy and communication in Ireland).

Engagement in applied policy-relevant research may also compromise the pursuit of independent research on potentially controversial topics (Slaughter and Leslie, 1997; Martin, 2010). For example, it remains unclear whether and to what extent publicly or privately funded research that aims to be relevant to policy-makers and/or practitioners can accommodate dissent or resistance to current policy or 'good practice' grassroots initiatives. In fact, practical actions have often emerged through bottom-up grassroots activities or top-down policy interventions that incorporate diverse sources of knowledge and expertise but that have only limited connections with the realm of science (Seyfang and Smith, 2007; Jaeger-Erben et al., 2015). Exchanges between sustainability scientists, policy-makers, and practitioners that facilitate an open and (self-)critical exchange of views remain scarce (Sedlacko et al., 2013; Russell-Smith et al., 2015).

Practical challenges that mar policy-relevant sustainability research can occur across the entire research process, from initial project design to final analysis and interpretation of results. Even though one of the goals of sustainability research is to promote integrated thinking, the realities of (funded) research can prevent deep integration. For example, designing projects as part of funding applications requires adherence to certain structural conventions, including breaking down projects into discrete 'work packages' that may or may not be (re-)integrated during the research, or creating sectoral 'silos' whereby closely related areas of resource use (e.g. energy, water) are dealt with entirely separately.

Moreover, policy-makers often prefer research with a short time span that promises rapid turnaround and quick delivery of results,

which often clashes with institutional time cultures within academia that involve multi-year research cycles. Further exacerbating these 'cultural clashes', policy actors frequently criticise academic research for having 'too complex views', 'too time-consuming methods' and 'too contingent conclusions' (Bell, 2011, p. 217). Given the centrality of long-term thinking in sustainability theory and practice, this preoccupation with the speedy delivery of research results seems somewhat paradoxical (Rau and Edmondson, 2013).

Short-term thinking also dominates the domain of research management and governance, creating tensions between those who conduct research and those who manage and assess it. The latter frequently show limited awareness that the scientific and societal impacts of research may only become visible after an extended period of time that exceeds the time span of most conventional impact assessment procedures (Silburn et al., 2010; Singh et al., 2012; Penfield et al., 2014; Rau et al., 2014; McNie et al., 2016; Tsey et al., 2016). For example, inquiries into the success of the city of Copenhagen in promoting cycling as key transport mode reveal the very long-term nature of creating a more sustainable mobility culture, with evidence spanning the entire post-WWII era until today (Gössling, 2013).

Regarding methodology, the dominance of quantitative approaches in applied sustainability research regularly manifests itself in calls for 'solid' data based on representative samples and replicable research designs (Mårtensson et al., 2016). In contrast, qualitative approaches are often perceived as 'soft' and 'not rigorous' and are thus less likely to attract funding (Flyvbjerg, 2006; Rau and Fahy 2013). This emphasis on quantification is mirrored in debates and policy initiatives that prioritise directly measurable sustainability outcomes, such as concrete reductions in greenhouse gas emissions or metered energy use (Nissinen et al., 2015). Importantly for this paper, this emphasis on quantification clearly extends into the realm of research quality assessment, presenting numerous challenges for measuring the (lack of) impact of this type of knowledge production (Schäfer et al., 2010; Brandt et al., 2013). The remainder of this article attends to these impact-related challenges.

2.1. The emergence of 'impact' in research quality assessment

Parallel to the rise in transdisciplinary work described above, academics have come under immense pressure to demonstrate the 'value' of their work, which is often narrowly defined as the benefits of research investment versus the cost (Fahy and Rau, 2013a; Tsey et al., 2016; Mårtensson et al., 2016). Related assessments of the research performance of individuals and organisations have been strongly shaped by the availability of data for bibliometric analyses. More recently, this has been complemented by the collection of non-traditional metrics and qualitative data such as evidence of (social) media coverage or online peer reviews, as exemplified by the Altmetric system (www.altmetric.com). However, this academia-centric understanding of research quality often ignores non-academics' views and experiences of what types of research are relevant to them, or how exactly they impact society. Moreover, it has sidelined broader, more inclusive views of research quality and impact that explicitly value academic freedom, creativity and integrity. For example, the number of 'stakeholders' involved in the research process is now frequently used as a yardstick for societal impact, regardless of whether these 'stakeholder engagements' have been beneficial or not, or how insights arising from them have (not) been used by researchers (Mårtensson et al., 2016). More complex assessments of the implementation of research results in wider society that go beyond these relatively simple stakeholder engagement metrics remain scarce (McNie et al., 2016). This said, selected national programmes such as the Research Excellence Framework (REF) in the UK and the Standard Evaluation Protocol (SEP) in the Netherlands now include more qualitative approaches to such as narratives and case studies (REF, 2014; VSNU et al., 2014).

Another paradox inherent in calls for high-impact research concerns the erroneous assumption that the (ir)relevance of a project can be

known from its very inception, and that its impact can be carefully planned and crafted. The trajectory of a research project is contingent upon a range of project-internal and external factors, including its wider political and policy context. Consequently, research may not turn out to be relevant as originally envisaged (Tsey et al., 2016). In contrast, research that initially appeared unlikely to have any distinct practical application might end up producing unanticipated outcomes (REF, 2014).

Moreover, interested parties are not always in a position to act immediately on new research findings and results thus need to remain accessible for long periods of time. The continued relevance of historical examples of high-quality social inquiry, such as Veblen's (1899) work on social class and conspicuous consumption, for contemporary social, trans- and interdisciplinary research on (un)sustainable consumption aptly demonstrates the lasting impact of carefully crafted research. Furthermore, potential time lags between research-related change initiatives and their actual effects, and lack of researcher control over the implementation of recommendations make it extremely difficult to measure the wider societal effects of research (Tsey et al., 2016; McNie et al., 2016). Long-term monitoring of sustainability initiatives continues to be the exception, leaving large gaps in understanding their varied and possibly non-linear effects across time (Rau and Edmondson, 2013).

While impact has only recently emerged as a concern for those who evaluate the research performance of individuals and institutions, a regrettable narrowing of the debate and associated measurements has already occurred. For example, it is now increasingly common to count peer-reviewed publications, the amount of funding received, or PhD and postdoctoral researchers supervised to establish the suitability of academics for promotion, or to allocate public funding to universities and other third-level institutions. Qualitative or hard-to-measure aspects of impact are often excluded from research evaluations altogether, or ranked below conventional 'performance indicators' such as publications. For instance, some staff promotion schemes used in Irish universities list impact as criterion for assessing applicants' research and scholarly standing as well as their external contribution. Here, impact has been defined as including patents, licensing agreements, liaison with industry, authorised consultancy work, campus companies, placement of students or graduates, or cultural, economic and social impacts (e.g. NUI Galway, 2015).

Against the backdrop of mounting reservations to conventional approaches to impact assessment, efforts continue apace to capture less tangible outcomes of scientific research, and reward academics engaged in 'non-traditional' activities such as co-production of knowledge, outreach, policy advice, or action research involving communities facing serious sustainability challenges. As Mårtensson et al. (2016) observe, '[...] it is becoming more and more common for scientific output to be measured in ways other than simply counting the number and quality of publications' (p.594). This has been welcomed by those who have used non-traditional research outputs such as factsheets, video clips, social media coverage or face-to-face interactions with local actors and communities. While acknowledging that the system is imperfect, advocates argue that making impact an integral part of institutional processes (e.g. promotions) has the potential to change the academic reward system in the long term (cf. Penfield et al., 2014; LERU, 2017). Yet others have promoted radically different approaches to impact and its assessment that challenge the prioritisation of economic usefulness and its quantification (e.g. Small, 2013; Belfiore, 2015).

2.2. Moving beyond citations? alternative approaches to impact assessment

Alternative forms of impact assessment that capture the complexity of the short-, medium- and long-term effects of research and that work across different areas and disciplines clearly demand new ways of thinking and measuring (Spaargaren, 2011; Fahy and Rau, 2013a; Singh et al., 2012). For example, established evaluation criteria for

projects and publications in the natural sciences have repeatedly been shown to be less suitable for social scientific and interdisciplinary sustainability research, although this has yet to be translated into more inclusive impact assessment tools that enjoy widespread acceptance. Nevertheless, some attempts have been made to develop new criteria and indicators that go beyond conventional bibliometric analyses (e.g. Mårtensson et al., 2016; McNie et al., 2016). For example, Mårtensson et al. (2016) contribute to the growing body of criticism concerning the linearity of 'Mode 1' science and its evaluation. Recognising that the 'ambition to evaluate research has a long history that is full of tensions, ambiguities and misunderstandings' (Mårtensson et al., 2016: 594), they propose to include in research quality assessment many of the less tangible influences on the trajectory and outcomes of research such as intuition and passion. Their work introduces an exemplary model for the development of comprehensive research quality criteria, designed specifically for deployment across disciplinary boundaries. Based on extensive participatory work with internationally renowned researchers, their comprehensive quality model addresses four main questions:

1. Is the research credible?
2. Does it contribute to science and society?
3. Can the research be effectively communicated?
4. Does the research conform to established ethical and research quality standards?

Based on material generated during the expert workshops, Mårtensson et al. (2016) present 32 concepts that can provide the foundation for rigorous quality assessment across these four key areas (*credible, contributory, communicable, conforming*). Importantly, in their concept hierarchy 'contributory' covers research that is original, relevant, generalizable, and contributes to science and/or society (Mårtensson et al., 2016: 599).

The concept of 'science usability' has also emerged as a credible alternative to conventional research quality assessment (Dilling and Lemos, 2011; Lemos et al., 2012; Kirchhoff et al., 2013; Lemos, 2014). For example, Dilling and Lemos (2011) promote an improved understanding of both opportunities and constraints concerning the use of science in climate policy. Interestingly, they observe that 'nearly every case of successful use of climate knowledge involved some kind of iteration between knowledge producers and users' (p. 680). The identification of different types of users and divergent forms of use add further nuance to the science usability debate. For example, Kirchhoff et al.'s (2013) aforementioned typology of users of climate information clearly recognises variations in knowledge-to-action flows that relate to both decision-makers' personal characteristics as well as the wider institutional conditions that these people operate in. Concerning different forms of use, Nutley et al. (2007), Meagher et al. (2008) and Meagher and Lyall (2013) distinguish between *conceptual use, instrumental use and capacity-building*. They argue that research with high levels of conceptual use changes ways of thinking, alerts policy-makers and practitioners to an issue, or plays a more general 'consciousness-raising role'. In contrast, instrumental use encompasses any direct impact of research on policy and practice decisions. Finally, capacity-building refers to education, training or even development of collaborative abilities that result directly from the research activities. According to these authors, efforts to measure these three types of impact on public policy and practice require the development and application of 'proxy indicators of connectivity' that are rooted in a nuanced understanding of the quality of knowledge exchange between researchers and users (Meagher et al., 2008: 163).

The recent push for novel ways of conceptualising and measuring impact has provided fresh opportunities for both academics and non-academics to debate the societal relevance of research more generally, and inter- and transdisciplinary sustainability studies in particular. This paper contributes to these debates through detailed examination,

critical reflection and nuanced discussion of the scientific and societal impacts of CONSENSUS, our own research on sustainable consumption. Following a description of our methodological approach in Section 3, we draw on Nutley et al. (2007), Meagher et al. (2008), Meagher and Lyall (2013) and Mårtensson et al. (2016) to structure our own qualitative assessment of the impact of CONSENSUS (Section 4). Recognising that the wider implications of projects such as CONSENSUS might be more difficult to capture, especially those that emerge in the longer term, we offer some suggestions for recording and explicitly valuing them (Section 5).

3. Methodology

A case study approach was adopted for this study, focusing on a large-scale sustainable consumption (SC) project undertaken over a seven-year period (2009–2015) in Ireland. The CONSENSUS project pursued an internationally-focused analysis of the interactions between consumption and the environment under the aegis of sustainable development, with an explicit focus on the embedded and embodied everyday practices that people engage in and that require the use of diverse resources (e.g. water, energy food, transport infrastructure and services).

The project involved ten academic researchers from Trinity College Dublin (TCD) and the National University of Ireland, Galway (NUIG) with expertise in the fields of Geography, Information Technology, Political Science, Psychology and Sociology. The advisory board for the project included international researchers in the field of SC, as well as representatives of state and semi-state agencies responsible for policy development in the fields of energy, food, water, and transport. CONSENSUS was awarded as part of the government-funded Science, Technology, Research and Innovation for the Environment (STRIVE) Programme 2007–2013. The programme was administered on behalf of the Department of the Environment, Heritage and Local Government by the Environmental Protection Agency (EPA), whose statutory functions include the coordination and promotion of environmental research, in addition to environmental planning, licensing, monitoring and management, enforcement of environmental law and climate change goals, strategic environmental assessment and education and guidance.

Data for the quasi-longitudinal, qualitative impact assessment for CONSENSUS was collected through a thorough desktop review of project outputs and dissemination activities, the use of analytical tools to demonstrate the impact of CONSENSUS publications, videos, social media, etc., documentary analysis, and other secondary data. These were complemented by a survey designed specifically to gather the views and opinions of researchers regarding the impact of the project, both on their personal career and on wider society. The survey was completed by the aforementioned ten researchers who worked directly on the project and five additional researchers who used CONSENSUS material in subsequent work. As well as direct impacts, all 15 respondents who participated in the survey in October 2016 were asked to identify less visible aspects such as spin-off projects, related grant applications, the use of project materials in sustainable consumption research and teaching in Ireland and internationally, on-going career development, and reputational impact. It was envisaged that continuing to collect data about research impact after the project was finished would reveal fresh insights into ways that researchers can improve research impact (Silburn et al., 2010). In addition, the collation of various sources and types of data facilitated a broad evidence-informed impact assessment throughout the various stages of the research process that focused on both directly observable and intangible elements.

Following a qualitative approach to data collection and analysis, a broad range of primary and secondary information was used to comprehensively map CONSENSUS outputs. These were subsequently categorised and grouped into three broad domains depending on the targeted audience – academic, policy and civil society (see Table 1). Drawing on key publications on usability reviewed in Section 2, it was

possible to assess CONSENSUS outputs in relation to their conceptual use, instrumental use, and capacity-building. This was complemented by an appraisal of the quality of each type of output based on a checklist covering Mårtensson et al.'s (2016) four main areas of research quality (credible, contributory, communicable and conforming) and associated criteria. Concerted efforts were made to reach inter-rater agreement. A researcher external to CONSENSUS conducted the primary evaluation and subsequently discussed his findings with two of the project's principal investigators for the purpose of building common ground. For example, there was general agreement that the policy-focused outputs had higher levels of instrumental use than academic outputs – which tended to be overlooked by policy-makers and practitioners –, whereas academic, policy and civil society focused outputs were understood to build capacity among the different target groups.

3.1. CONSENSUS: connecting science and society through sustainable consumption research

CONSENSUS brought together expertise from not only a broad spectrum of academic disciplines (which differed significantly in terms of their conceptual and methodological orientations, and established research practices), but also policy actors, designers and practitioners with their diverse approaches to dissemination and communication. Building a basic set of shared concepts and ideas within the research group, the project deployed a number of mutually complementary conceptual frameworks and a wide range of research methodologies, including surveys, interviews, participatory action research and visioning techniques. The project's strong interdisciplinary orientation was complemented by some transdisciplinary empirical elements (e.g. visioning and backcasting workshops with key actors; see below for details).

Central to CONSENSUS was the belief that a shift towards more sustainable consumption (SC) would require radical changes in prevailing systems of provision and concerted action by public authorities (at all levels), businesses and consumers (European Commission, 2012). The project's explicit focus on households recognised their key role in global (un)sustainability and their close links with policy, regulation and economic influences. The results and recommendations from the project are not the focus of this paper and have been published elsewhere (e.g. Davies et al., 2014; Davies and Doyle, 2015). However to summarise these briefly: The foundational phases of the project reviewed existing policy, international good practice and tools for governing sustainable consumption and a Lifestyle Survey was then designed to measure people's attitudes and behaviours towards sustainable household consumption across four key areas (food, energy, mobility and water). Involving 1500 respondents across Ireland, results revealed high levels of environmental concern, awareness and self-efficacy, and a reported willingness to act in order to protect the environment. However, it also showed significant discrepancies between reported environmental concerns and everyday practices (Lavelle et al., 2015).

The subsequent exploratory phases of CONSENSUS combined qualitative and quantitative methods to investigate both individual-level and societal barriers to pro-environmental action. Recommendations from the transport and mobility strand of research included a re-conceptualising of everyday mobility as the 'consumption of distance' as a promising departure from hitherto dominant technocentric and economic views in mobility research, policy and practice (Heisserer and Rau, 2015). It also highlighted the urgent need for cross-sectoral policy solutions to pressing transport problems experienced by people who consume too much distance, as well as those who find themselves deprived of opportunities for personal mobility. Reframing of problem arenas also took place in relation to householders' water, energy and food practices. Here, a practice-oriented participatory (POP) backcasting approach generated proposals for regulatory, socio-cultural and technical innovations to promote more sustainable household

consumption. The POP backcasting process produced future scenarios for the year 2050 and related Transition Frameworks. It was shown that involving a variety of business, policy, non-governmental and civil society actors in POP backcasting can serve as a possible governance mechanism for coordinating and aligning long-term policy and business goals for shifts in unsustainable consumption practices (Rau et al., 2014).

Overall, CONSENSUS advanced understanding of both individual and structural influences on everyday practices and related use of key resources while also identifying regulatory, technological and lifestyle changes that could enhance sustainability at the household level. In doing so, the project engaged over 100,000 members of the public, along with over 150 government, private sector and civil society actors (Table 1). Extensive dissemination through project publications, creative online resources and social media activities has ensured that the research findings have attained an international profile and audience beyond academia.

It is important to note that unlike other recent large-scale sustainable consumption projects,³ CONSENSUS was not explicitly designed to investigate or improve the science-policy-practice interface in the sustainability research arena. However, we decided to reflect critically and systematically on our experiences during the project, with a view to adding to the growing body of knowledge in relation to impact. The next section considers the impact, or lack thereof, of the CONSENSUS project, with particular emphasis being placed on less tangible, indirect and long-term aspects of impact.

4. Unpacking the ‘impact’ of CONSENSUS

The CONSENSUS project has established general baseline data and in-depth sectoral knowledge of consumption, progressing academic, public and policy debates across the island of Ireland in the process. Drawing on international good practice from science-policy knowledge exchange, and taking on board calls for scientists to produce more useable, policy-relevant knowledge, all members of the CONSENSUS research team were cognisant of the need for effective processing and presentation of insights from the study. In addition to peer-reviewed publications, regular engagement with policy makers and civil society constituted a core activity of CONSENSUS team members (Table 1). An internet-based platform was central to its dissemination strategy. Overall, such dissemination, while time consuming and challenging, provided opportunities for fruitful exchanges with diverse scientific and non-scientific communities.

As can be inferred from Table 1, many of the CONSENSUS outputs meet the assessment criteria in relation to both usability and quality. However, some gaps in conceptual and instrumental use remain, especially in the academic output section. This suggests that researched efforts to change traditional views of (un)sustainable consumption and transform consumption policy and practice continue to meet considerable barriers. On the other hand, some aspects of policy and civil society engagement may have somewhat reduced the scientific quality and rigor of outputs, in particular in situations where findings had to be presented in a truncated way to meet time-constrained publics. Nevertheless, the dissemination of findings has been relatively extensive, and will no doubt continue as further outputs are published. Moreover, the project’s impact has extended well beyond the confines of the discrete research events, albeit in unpredictable ways (for a full discussion see Davies and Doyle, 2015).

Concerning the project’s impact beyond the seven quality and usability categories listed in Table 1, exchanges with non-academic actors clearly opened up opportunities for shifts in views and (argumentative) practices. Participants’ preconceptions about more sustainable heating,

washing, eating and mobility practices were often challenged, sometimes modified, and even radically altered through their engagement in CONSENSUS. For example, individuals from different professions, and with diverse motivations and drivers, were willing to come together in transdisciplinary workshops, with the common purpose of imagining more sustainable alternatives. CONSENSUS temporarily opened up ‘spaces of hope’ (Harvey, 2000) for solutions-focused activity, contrasting with much popular discussion of socio-environmental challenges that features scenarios of impending doom. Nevertheless, these activities will remain isolated experiments in interaction, creativity, reflection and innovation unless they succeed in reshaping key aspects of consumption. Similarly, learning effects may be transient unless context-specific knowledge co-created by CONSENSUS workshop participants becomes part of the *modus operandi* of the organisations from which participants emanated. In the remainder of this section we will reflect critically on three examples highlighting some of the impacts of the project on: (1) the local and national sustainability and SC research landscape; (2) international research agendas and activities; and (3) sustainability policy and practice in Ireland.

4.1. Impact on local and national sustainability and SC research landscape in Ireland

Prior to the commencement of the CONSENSUS project, SC research was only in its infancy in Ireland. CONSENSUS has built significant capacity in this area, not only within the research community of Ireland and amongst the team members, but also within public, private and civil society spheres through participatory workshops, conferences and presentations (see Table 1). It developed intellectual capacity on SC through the training and mentoring of three PhD and four post-doctoral researchers employed directly on the research project, as well as researchers on spin-off projects utilising concepts, methodologies and data from CONSENSUS as their foundation. For example, in 2014, Science Foundation Ireland (SFI) funded an innovative collaborative project on energy retrofitting that brought together social science and engineering expertise and that built on and extended insights from CONSENSUS.⁴ Furthermore, all lead CONSENSUS academics were active lecturers in their respective institutions. In addition to fourth level supervision, they developed courses in Geography, Sociology and Political Science around the theme of (un)sustainable consumption based on their work on the project. More than 3000 undergraduate and postgraduate students have enrolled in these courses since 2010. One of the team members also provided a video-recorded summary of key insights from the CONSENSUS mobility work package for the SCORAI (Sustainable Consumption Research and Action Initiative) Europe network (<http://scorai.org/teaching/videos/>). The long-term effects of these teaching and training efforts on consumption-related views and practices in Ireland and beyond will only emerge in years to come.

4.2. Influences on international research agendas and activities

The identification of significant gaps in the global SC research landscape formed a significant part of CONSENSUS and subsequently shaped European and international research agendas. In 2014, two CONSENSUS team members led the development and submission of a concept paper to the European Commission on behalf of SCORAI Europe. The position paper built directly on key insights from CONSENSUS to propose a resource-consumption-hierarchy (RCH) (Fig. 1) that can be used as a heuristic for ranking different forms of consumption, ranging from ‘green’ consumption at the bottom to dramatically reduced consumption at the top. This, in turn, influences the degree of (un)desirability of different Sustainable Consumption and

³ See for example CORPUS: Enhancing the Connectivity Between Research and Policy-Making in Sustainable Consumption accessible at www.scp-knowledge.eu/corpus-project.

⁴ <http://jamiagoggin.wix.com/nzeb-retrofit#!socio-technical-innovations/c1p8c> (last accessed 10 October 2016).

Table 1
Impact, usability and quality of CONSENSUS output*.

Output	Description	Direct impact	Conceptual use	Instrumental use	Capacity building	Credible	Contributory	Communicable	Conforming
Academia									
Peer-reviewed publications	Publications in national and international peer-reviewed journals including <i>Global Environmental Change</i> and <i>Journal of Consumer Culture</i>	35 publications; 249 citations (including 75 self-citations – based on Google Scholar, data collected in November 2016)	✓		✓	✓	✓	✓	✓
Books	Two edited volumes: <i>Challenging Consumption: Pathways to a more sustainable future</i> (2014, Routledge) and <i>Methods of Sustainability Research in the Social Sciences</i> (2013, SAGE).	Major contributions to SC research and teaching	✓		✓	✓	✓	✓	✓
Research reports	Two major end-of-project research reports	Dissemination of project results and recommendations for policymakers	✓	✓	✓	✓	✓	✓	✓
Presentations	98 oral and 8 poster presentations internationally	106 presentations delivered to international audiences	✓		✓	✓	✓	✓	✓
International conferences	Two SC themed international conferences (2012 & 2015) hosted by NUI Galway	As well as being well attended, recorded lectures from the conferences have been viewed 3000+ times.	✓		✓	✓	✓	✓	✓
PhDs complete	Completed PhDs supported through the CONSENSUS project	Three researchers obtained PhD's based on SC research	✓		✓	✓	✓	✓	✓
Postdoctoral researchers	Training and experience in using new research skills and methodologies	Four SC researchers upskilled	✓		✓	✓	✓	✓	✓
Research awards	Subsequent funding and research awards by academics directly linked to CONSENSUS including SFI (e.g. nZeb-Retrofit), EU-H2020 (e.g. ENERGEISE) and ERC (e.g. SHARECITY).	New research funding to the value of > €8 m and opportunities, conceptual and methodological advances; empirical contributions to international SC research field	✓		✓	✓	✓	✓	✓
Spin-off research projects	Projects that indirectly build on the work of CONSENSUS including Master's thesis and PhD dissertations (e.g. Goggins and Rau, 2016).	Providing foundations for further research in the areas of food (Gary Goggins, Bridin Carroll) and energy (Mary Greene)	✓		✓	✓	✓	✓	✓
Career development	Increased national and international recognition, intellectual and conceptual development, building networks, etc.	Personal career advancement for CONSENSUS researchers	✓		✓	✓	✓	✓	✓
Teaching	Development of new sustainable consumption courses (e.g. Geographies of SC – NUIG) and complementary teaching materials	Increased numbers of students studying SC issues; greater awareness of SC, new teaching tools and materials	✓		✓	✓	✓	✓	✓
CONSENSUS tools and methodologies	Advancement of new research tools and techniques	Methodologies replicated in other contexts (e.g. CONSENSUS Lifestyle Survey used by researchers in Oregon, US and by researchers on the nZEB-Retrofit project in Ireland)	✓		✓	✓	✓	✓	✓
Policy									
Policy engagement	Contributions to national (e.g. National Economic and Social Council) and international (e.g. OECD) policy proposals	Informing policy decision-making	✓	✓	✓	✓	✓	✓	✓
Policy recommendations	Identification and promotion of new policy relevant research priorities through reports and policy briefs	Shaping policy agenda	✓		✓	✓	✓	✓	✓
Governing tools	Produced a catalogue of international best practice SC models and a review of Ireland's progress in this field	Raising education and awareness of SC issues and progress among policy-makers and others	✓		✓	✓	✓	✓	✓
Transition Frameworks	Three documents outlining a series of policy, R&D and educational interventions for sustainable living practices from the present-2050	Transition Framework documents were disseminated to local authorities across Ireland (North & South)	✓		✓	✓	✓	✓	✓
Civil Society									

(continued on next page)

Table 1 (continued)

Output	Description	Direct impact	Conceptual use	Instrumental use	Capacity building	Credible	Contributory	Communicable	Conforming
Exhibitions	'WaterWise' exhibition in Dublin, New York and Canada	Education and awareness, received more than 100,000 views from gallery visitors	✓	✓	✓	✓	✓	✓	✓
Lifestyle survey factsheets	Nine factsheets synthesising results from the CONSENSUS Lifestyle Survey	Disseminated to over 250 key actors, including advisory board members, local and national media and local authorities	✓	✓	✓	✓	✓	✓	✓
Media communications	Newspaper articles; radio interviews; podcasts; press releases	Knowledge exchange; education; shaping public opinion	✓	✓	✓	✓	✓	✓	✓
Online material	Findings have been communicated through a dedicated website and newsletter, social media, international research networks and government agency websites.	Dissemination and communication of research findings to various users (e.g. > 2000 followers on Twitter)	✓	✓	✓	✓	✓	✓	✓
Video short animations	Innovative motion graphics based on the CONSENSUS research project methods and findings.	Education and awareness, three videos have been viewed over 12,000 times	✓	✓	✓	✓	✓	✓	✓
Knowledge exchange	Mutual learning and understanding facilitated by participatory research processes involving diverse groups of actors.	Reciprocal learning and engagement through collaboration with over 150 key actors including NGOs, businesses, local authorities, policy-makers and research institutions.	✓	✓	✓	✓	✓	✓	✓

*Data collection concluded in November 2016.

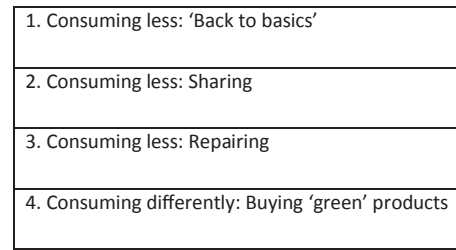


Fig. 1. The Resource-Consumption-Hierarchy.

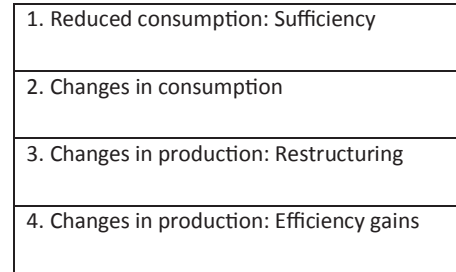


Fig. 2. The SCP Policy Priorities.

Production (SCP) policy priorities (Fig. 2).

CONSENSUS findings highlighted that interactions between environmental, economic and social impacts associated with the four layers of the RCH remain poorly understood, and that considerable variations exist among EU member states regarding the relative importance of each level. CONSENSUS also demonstrated that many SC activities in Europe tend to concentrate on the bottom two layers (buying and repairing), where environmental impacts remain relatively high (Pape et al., 2011). The top two layers (sharing and 'back to basics') require a significant transformation of consumption practices but promise greater environmental gains. However, CONSENSUS revealed that the latter's practical applicability has not yet been adequately demonstrated, especially at the meso level of social organisation (e.g. firms, public institutions) (Davies et al., 2014). This demonstrates the need for further SC research in Europe and internationally that moves beyond conventional 'Mode 1' research designs, to include and engage key actors in the SC field from the beginning.

4.3. Shaping sustainability policy and practice in Ireland

To shape sustainability policy in Ireland, CONSENSUS Lifestyle Survey data and international good practice examples were translated into proposals for national policy-making institutions. For example, CONSENSUS results highlighted how a sustainability transition in the energy sector requires the integration of education, policy, research, and business and technology agendas through cross-departmental collaboration, with one central department (e.g. Department of Energy) leading the development of long-term strategy and integrating cross-departmental work. Interestingly, the existing split of responsibility for SC across departments also presented a key challenge for the CONSENSUS team, in particular with regard to achieving policy impact. Regular face-to-face meetings with policy-makers and agency representatives throughout the lifespan of the project revealed that many government actors were unsure about the relevance of the findings for their particular departmental brief. Despite these challenges, CONSENSUS continues to impact on national policy (e.g. the Climate Action and Low Carbon Development Bill, Government of Ireland, 2015).

The research team dedicated significant time and resources to the development and design of key research outputs. Over the seven-year duration of the project, detailed recommendations for sector-specific action on SC across organisational, behavioural and regulatory arenas

were disseminated. For example, the Transition Frameworks proposed concrete measures for policy-makers, education and community workers, research and business innovators alike, to achieve greater sustainability in home-heating, washing and eating over the short-, medium- and long-term. Similarly, opportunities and challenges associated with teleworking and employer-based mobility management initiatives were explored in the context of complementing conventional transport policy to achieve the SC of distance.

Complementing these sectoral suggestions for change, a suite of general actions was proposed. These included the creation of an inter-departmental working group within national government to ensure SC policy consistency and complementarity, coupled with a shift in policy attention beyond a focus on ‘efficiency’ to a focus on ‘sufficiency’. While the development of a SC working group is hardly a radical suggestion *per se*, shifting policy focus towards sufficiency is likely to be highly contentious and unpopular among economically orientated policy-makers and business actors. Such a shift towards sufficiency would need to complement technology-related efficiency targets with ambitious goals for deep cultural change (in norms, values and behaviours) concerning everyday consumption practices. This also requires research-led processes for developing recommendations for both immediate-term policy actions and long-term SC goals (Davies and Doyle, 2015). The extent to which these suggestions will have impact into the future is uncertain. It also remains to be seen whether policy-makers in Ireland and internationally will be prepared to accept both qualitative and quantitative data that are collected using less conventional methodologies such as backcasting and visioning. With this in mind, the next section critically discusses what the CONSENSUS experience can contribute to others engaging in the design and implementation of evidence-based sustainable development policies more generally.

5. Discussion: enhancing connectivity between sustainability research, policy-making and practice

Scrutinizing the impact of the CONSENSUS project has revealed possible new ways in which knowledge and expertise exchange between scientists, policy-makers and practitioners and resulting scientific and societal impact could be made visible, assessed and further enhanced in practical terms. CONSENSUS drew a broad array of disciplines to design research, produce insights and derive concrete solutions to the challenges of unsustainable consumption. Within the project, both the large-scale survey and the cataloguing of good practice examples established a comprehensive baseline but also served to accommodate policy actors – as these approaches to data collection produce the highly sought-after ‘solid’ data. Combining these conventional methods with four exploratory empirical elements that incorporated transdisciplinary and participatory methods ensured a balance between methodological innovation and funders’ requirements. It also reflected a commitment to methodological pluralism that mirrors many inter- and transdisciplinary sustainability studies and that challenges expectations among policy-makers about *how* research should be conducted, including the role of diverse scientific and non-scientific actors in the research process (Fahy and Rau, 2013b; Davies et al., 2014).

Innovative dissemination strategies to try to maximise the conceptual and instrumental use of results by wider audiences, including those in charge of policy, complemented these efforts. As shown in this paper, some aspects of impact could be quantified rather straightforwardly. However, it is also evident that a more comprehensive impression of the impact of CONSENSUS may only become apparent after an extended period of time, and through the application of alternative forms of impact assessment that capture the (often intangible) effects of multi-directional science-society exchanges and knowledge co-production. For example, different forms of usability described by Nutley et al. (2007) and Meagher and Lyall (2013) only became apparent through careful mapping of discussions, references and citations of our research

in policy documents, and its subsequent implementation.

Regarding education, training and development of collaborative abilities, CONSENSUS built significant capacity, not only within the research community of Ireland and amongst the team members, but also within public, private and civil society spheres through workshops, conferences and presentations. It opened up additional research opportunities both directly (e.g. subsequent EU-funded projects) and indirectly (e.g. spin-off PhDs). Moreover, the number of undergraduate and postgraduate participants in SC courses offered by CONSENSUS team members continues to rise, presenting recurring opportunities for dissemination and multiplication of research findings.

While we have discussed the opportunities and spaces for reflection that our research has potentially created, mapping the *conceptual use* of our research (i.e. changing traditional ways of thinking about SC and raising awareness among non-academic audiences) remains an ongoing and challenging endeavour. While there is evidence that the funding authority have used CONSENSUS as a model of good research practice, we cannot say for certain if it has fundamentally altered their research agenda, or indeed their attitudes towards impact assessment. Similarly, the project’s overall impact on the long-term national policy agenda remains unclear. In terms of education for SC and raising awareness with SC issues, the project clearly has had a significant impact.

Overall, we can conclude that the participatory processes inherent in CONSENSUS and their potential for fostering collaborative knowledge production far exceeds any current decision-making procedures concerned with household practices and associated aspects of consumption, certainly within Ireland. However, quantification of such a claim remains problematic. Reflecting on lessons learned from our experiences, it is crucial to acknowledge that there are always circumstances that cannot be planned for. For example, it was interesting to observe the broadening of the research dissemination and ‘impact’ remits as the project progressed. From the initial research design stage, the key research objectives included production of recommendations for local authorities and national decision makers concerning SC policies. However, funder requests for wider dissemination increased dramatically as the project progressed, reflecting the importance of greater accountability for public funds in a changing economic climate. This highlights how the timing and context of a project can be vital in sculpting the research process and resulting impacts. Retaining flexibility and being open to uncertainty is key, more so in light of the many outputs that emerged over the course of the project, and that we had never envisioned in the initial proposal.

6. Conclusion

In light of these recommendations, it is useful to revisit our earlier discussion of the role of inter- and transdisciplinary sustainability research in creating opportunities for participatory science-policy-practice exchanges. Universities are increasingly expecting their academics to produce and disseminate knowledge differently, yet in our experiences they lack commitment in terms of adequately recognising such ‘Mode 2’ efforts. For example, dedicated outreach roles and well-resourced support systems for tailored communication and dissemination of research to policy-makers and wider communities are urgently needed but remain the exception. Another important structural support is the availability of funding for potential spin-offs, including project extensions that may only be identified as the project progresses. The funding of CONSENSUS by Ireland’s Environmental Protection Agency brought with it its own impact potential; however, the EPA’s willingness to invest in the project beyond the initial four-year period clearly increased its scientific and societal impact rather dramatically.

Moreover, context remains an extremely important factor in any impact assessment. The success of a project is dependent on its planned versus actual achievements, particularly when assessed in relation to the project’s starting point. As demonstrated in the CONSENSUS project, a follow-on study might be expected to produce greater depth of

knowledge than an exploratory study. Additionally, as funders continue to request wider dissemination strategies and increasingly call for greater ‘impact’, this needs to be matched with appropriate and flexible supports. Little change can be expected as long as the rigid and un-critical incentivisation of peer-reviewed articles remains enshrined in academic performance metrics.

Impact has emerged as a focal point within debates on the benefits of policy-relevant research. However, comprehensive approaches to impact assessment that are capable of capturing more intangible forms of impact, especially concerning possible shifts in opinion and practices among key policy and civil society actors, remain the exception. Qualitative information on the accrued benefits to society is often neglected on favour of easy-to-measure quantitative data such as number of scientific publications or journal citations. This paper presented a mixed-methods approach to impact assessment that revealed both more visible and largely hidden impacts of a large-scale sustainability research project, thereby challenging narrow conceptions of impact that dominate many current research assessment exercises both in Ireland and internationally. It also revealed how sustainability researchers can use their work to create the space for innovative, creative and participatory knowledge exchanges with considerable societal impact. Finally, it seems wise to always remain cognisant of the complexity of impact, including potential negative implications of research on individuals and society.

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