

Making 'greener' connections: An introduction to the Special Issue

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'It is only by being specific about which aspects of governance tend to constrain rather than enable sustainable changes that we can better communicate what needs to change, and what the solutions should be, in ways that are tangible to elite and wider audiences'. (Kuzemko et al., 2016: 104)

The last 40 years have seen environmental issues rise sharply in both national and international agendas. What began as a concern about the deleterious effects of industrial activities on the natural environment (Parto, 2007) has grown as the effects of climate change have become apparent. This has resulted in concern not merely for environmental performance improvements but to promote a broader sustainable development agenda (Pinkse and Kolk, 2012; Griggs et al., 2013). It is now increasingly recognized that innovation policies have a positive contribution to make to improving environmental outcomes (OECD, 2009; Demirel and Kesidou, 2011; Blundel et al., 2012). This is reflected in the academic literature where a body of research into environmental innovations has emerged and is now growing rapidly, spread across a variety of disciplines.

This Special Issue of the International Journal of Entrepreneurship and Innovation brings together a set of papers that focus on social and technological innovations designed to address the environmental sustainability challenges that we face today. Several contributions were first presented as part of the Economic and Social Research Council seminar series, 'Green Innovation: Making it Work', which took place between 2015 and 2017.¹ Co-organized by Nottingham Trent University and The Open University, the series examined many types of pro-environmental innovation, with a particular focus on the factors that constrain and enable their practical implementation.

The choice of the broad and populist term 'green innovation' (Schiederig et al., 2012), rather than more specific terms like 'eco-innovation' or 'environmental innovation', was quite deliberate and intended to signal the intention to

create a forum for the interchange of ideas and research findings between academics with sustainability-related research interests, and sustainability practitioners drawn from the private, public and voluntary sectors. Practitioner engagement and participation was a prominent feature of the series, reflecting a desire to maximize the impact of the seminars outside academia. We were fortunate not merely to have practitioners attend the seminars, but to include papers from a number of them during the course of the series. Among the practitioners who gave papers during the course of the series were a Principal Administrator from the Energy Directorate of the European Commission, a transport consultant, a local authority transport planner, a property developer and a representative of a leading European train manufacturer. The Special Issue includes an article based on one of these practitioner-led presentations, while other seminar contributions have informed its overall shape and focus.

Over the course of the six seminars, we examined many examples of pro-environmental innovation policy and practice. With presenters drawn from a range of disciplinary backgrounds, including economics, sociology and psychology as well as the physical sciences and engineering, the seminars tackled a variety of topics and levels of analysis identified in the sustainability literature. They ranged from green business models and strategies (Boons and Lüdeke-Freund, 2013) to the role of specific policy instruments and institutional frameworks in facilitating innovation (cf. Foxon and Pearson, 2008; Geels et al., 2016; OECD, 2009; Wilson, 2012). We also organized seminars on energy and mobility applications. These

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focused attention on innovative approaches to mitigating environmental impacts in these sectors (cf. Ackrill and Kay, 2014; Wells, 2016) and included papers ranging from the use of former mine workings as an energy source for space heating to potential applications of fuel cell technology for powering cars and commuter trains.

At the concluding event, Andrea Westall highlighted a number of themes that had emerged from the preceding seminars²:

- *The broad conceptual challenges*: These included generating creative insights by integrating a diverse array of theoretical frameworks and disciplinary perspectives (e.g. transition theory, evolutionary economics, sociology and psychology); recognizing the importance of language (e.g. ‘green’ and ‘sustainable’); framing and scoping decisions; and managing the inherent tensions between rigorous and ‘objective’ analysis and a normative focus on directed change.
- *Understanding people’s needs and behaviours*: The discussions took us beyond purely economic drivers, with a number of speakers emphasizing the importance of understanding local context, addressing symbolic value, deploying trusted intermediaries and actively engaging people in pro-environmental behaviour change initiatives (e.g. promoting the adoption of low-carbon technologies and practices, devising strategies for extending product longevity and ensuring that the resulting innovations are maintained over time).
- *Developing effective business models*: Contributors pointed to a number of factors, including the need for appropriate incentives; the way that green innovation business models often extend beyond individual firms and take the form of cross-sector collaborations; and the potential for open business models, capable of connecting actors across a geographic region.
- *Brokering and integrating as a key role*: Following on from the previous point, several presentations identified the need for trusted organizations and individuals to act as brokers to facilitate the innovation process. Specific tasks included *integrating* technical specialists into a coherent team, *mediating* between the competing interests of small and medium-sized enterprises (SMEs) and larger firms and *translating* between academics and practitioner communities.
- *Cities and city regions as a nexus*: The responses of cities and city regions are central to addressing the environmental and sustainability challenges faced today. Several of the seminars featured case studies that presented practical responses being implemented in specific city settings, including Nottingham, Bristol and Hull in the United Kingdom and Copenhagen in Denmark. What emerged was the diverse nature

of the *governance* arrangements that prevailed in each location.

In this Special Issue, we are seeking to build on these core themes to promote a deeper understanding of the cultural, institutional and infrastructural changes required in order to achieve the transition to a more sustainable, low-carbon economy.

Making connections

Another key learning point from the seminar series was the importance of making more effective *connections* between institutional *governance* (including rules and regulations), the *practices* of actors within a particular domain (including incumbents and new entrants) and the *outcomes* achieved in terms of economic, social and environmental sustainability (Kuzemko et al., 2016). This issue was addressed, in different ways, by a number of seminar participants, including Matthew Lockwood (University of Exeter), Will McDowall (UCL), Fred Steward (Policy Studies Institute), Andrea Westall (The Open University), Paul Nieuwenhuis (Cardiff University), Kyriakos Maniatis (European Commission), Nick Ebbs (Blueprint Regeneration) and Lorraine Hudson (Hudson Sustainability Consulting).

This focus on making connections echoes Schumpeter’s seminal work, *Theorie der wirtschaftlichen Entwicklung* (Theory of Economic Development), in which innovation was characterized as the, ‘realisation of new combinations’. Schumpeter also highlighted the role of entrepreneurial actors in this process and presented the resulting dynamics as, ‘the overwhelming fact in the economic history of the capitalist society’ (Schumpeter, 1912: 159). However, this essential feature of societal progress has largely been forgotten by a mainstream economics profession whose principal theories tend to abstract from entrepreneurial agency and temporality (Casson, 2003; Hodgson, 2001; Ayres, 2017).

In the spirit of the seminar series, we encouraged practitioner–researcher collaborations, given their capacity to combine rich contextual insights with critical, theory-based analysis of the innovation process. However, while our primary interest is in examining the preconditions for successful pro-environmental innovation, we also recognize that it is important to avoid overly reductive ‘hero stories’ and have encouraged contributors to also acknowledge complexities and setbacks, to indicate where there is scope for further learning and, in so doing, to identify directions for future research.

Introducing the Special Issue contributions

This Special Issue comprises four main research articles, a teaching case study and a book review. The articles examine the cross-cutting themes of governance, practices and outcomes in a variety of ways. Each is grounded in an

empirical study, which addresses a specific set of practical challenges for a collection of actors, including entrepreneurs, innovators, governmental organizations and local communities. In framing their studies, the several authors draw on the multilevel perspective, a core component of the sociotechnical transitions literature (Geels, 2005; Geels et al., 2016; Bolton and Hannon 2016), in some instances combining it with relevant theories and concepts, such as co-evolutionary interactions (Foxon, 2011) and ‘product-service-system’ (PSS) business models (Mylan, 2015; Roy, 2000). The contributions can be loosely divided into two groups, household energy demand and sustainable personal mobility, with several overlapping elements. The first two articles (Killip and colleagues; Rossiter and Smith) are concerned with innovations that can reduce energy use, both in existing buildings and in new housing developments. The topic of sustainable mobility also makes an appearance in the second article, and is then pursued in various ways in the two remaining articles (Niewenhaus; Cook) and in the teaching case (Disney and colleagues).

Gavin Killip, Alice Owen, Elizabeth Morgan and Marina Topouzi examine innovation in the construction industry, with specific reference to renovation practices for low-carbon outcomes. As the authors point out, energy use in buildings accounts for almost one-third of total global final energy use (IPCC, 2014: 675), and given their relatively low rate of replacement it will be essential to make substantial, large-scale improvements to existing stock in order to meet current carbon reduction targets. However, prior research indicates that energy-related issues are not typically prioritized in repair, maintenance and improvement (RMI) activities. This is evident in what the authors describe as a, ‘large and persistent gap’ between the theoretical energy efficiencies of buildings at the design stage, and their real-life performance. Their study explores the ‘huge’ innovation challenge posed by the low-energy renovation of existing homes through a comparative analysis of four previous studies conducted in France and the United Kingdom. The authors adopt a co-evolutionary perspective to examine the three mechanisms (variation, selection and transmission) that are enabling or constraining innovation in five component systems: natural ecosystems, which form the policy context; institutions; user practices; business strategies and technologies. By applying this analytical framework, the article reveals previously obscured, or under-researched, aspects of the renovation process. For example, the authors are able to classify particular features of the process that enabled an innovation to progress from being a product or variation in one system to having the potential to effect a wider systemic change. They also draw attention to the close connections that are required between upstream product manufacturers and suppliers, designers and installers – a particular challenge for the UK’s traditionally fragmented RMI supply chain.

Will Rossiter and *David Smith* have collaborated closely with UK-based urban development company, Blueprint

Regeneration, including its founder and chief executive, Nick Ebbs, to provide a thoroughly grounded, practitioner perspective on the complex nature of the innovation process (www.blueprintregeneration.com). Their case-based account focuses on efforts to develop an integrated sustainable community in an inner city location. Not only has the Trent Basin Development transformed a severely degraded former industrial site, as the article outlines it also incorporates some novel approaches to fostering sustainable mobility and the provision of a sustainable energy supply, in addition to more established efforts to enhance the energy efficiency performance of new housing stock. However, the article does much more than focus on technological solutions, interesting and novel though they are, especially in relation to energy supply. It also highlights the need to take a more holistic approach to energy, from building design through to the everyday practices of residents. The article also indicates the importance of selecting and implementing appropriate governance arrangements, if significant outcomes are to be achieved, in terms of substantive changes in end-user behaviour that support and facilitate sustainability.

Paul Niewenhaus considers recent innovations within the car industry and assesses their potential contribution to a more environmentally sustainable approach to personal mobility. Having mapped out the principal technological developments of recent decades, including new powertrain solutions such as stop–start systems and ‘range extending’ hybrids, he tackles the more contested terrain of consumer behaviour, including the cultural constraints on the adoption of more radical solutions. His analysis draws on the sociotechnical transitions literature in order to examine the business models adopted by two new entrants that are seeking to introduce electric vehicles (EVs) into the existing automotive ‘regime’. The case material compares the growth of Tesla, a new EV manufacturer and marketer located in the United States and Autolib, a car-sharing company that operates a large fleet of vehicles in Paris and the Île de France region. As the author points out, while Tesla’s technological achievements have attracted a lot of media attention, the underlying business model is not such a significant departure from that of incumbent firms.³ By contrast, Autolib’s business model offers a PSS approach to personal mobility enabled by smart technologies and facilitated by close coordination with local government actors in Paris and the surrounding region. As such, it represents a more radical and *potentially* disruptive alternative to the existing regime. The author also concludes that state intervention, including regulatory frameworks and strategic infrastructural investments, will play a pivotal role in selecting between the available models and thereby shaping the future of personal mobility.

Matthew Cook’s article also examines innovation in relation to PSSs, in this case focusing on a new city bike hire initiative called ‘Bycycklen’ in the city of Copenhagen.

This initiative replaced a long-established bike scheme in the Danish capital and was designed to appeal to a wider range of users. The new scheme incorporated smart technology that offered the prospect of seamless integration with other transport modes through online booking and real-time information displays. However, as the article explains, the initial implementation was problematic, in part due to perceived deficiencies in the product, and to competition from low-cost alternatives. Analysis of the case suggests that there may have been flaws in the knowledge flows between different actors involved in this particular scheme. The apparent success of similar initiatives in other cities also suggests that, while some aspects of PSSs may be replicable in a variety of concepts, there is a strong co-evolutionary dimension to the innovation process. As a consequence, entrepreneurs and innovators also need to be sensitive to the particularities of time and place when they are conceiving and implementing new projects. In the author's view, this extends to a requirement for a more 'democratically legitimate governance', in which the voices of a wide range of local actors can be heard.

The teaching case study that forms part of this Special Issue is particularly topical given recent data from the World Health Organization (WHO) highlighting the impact of poor air quality in cities on human health (WHO, 2016). *John Disney, Will Rossiter and David Smith* examine the introduction of an express transit system in Nottingham, one of the nine cities in the United Kingdom that is currently breaching European Union standards for particulate emissions, and trace the steps being taken to overcome this problem and create a cleaner and safer city environment. The city's new tram network is a key feature of the case study. However, though trams are three times as energy efficient as conventional forms of urban public transport (i.e. buses), this account is not just another example of technology-led innovation. The three core themes of the Special Issue, namely, governance, practice and outcomes, are much in evidence within the case. In terms of practice, the case includes a novel way of funding innovation, in the form of the Workplace Parking Levy. This has not only provided a proportion of the funding for Nottingham's new tram system, it has also served a valuable regulatory function, by restricting car use. Another important aspect of practice to emerge is the extent to which those planning Nottingham's tram were able to learn valuable lessons from earlier tram schemes in other parts of the United Kingdom. The case also provides some especially interesting illustrations of the governance theme. It clearly shows the value of having a single promoter in terms of: clarity of purpose for a major development project, establishing well-defined relations with partner organizations and integrating this form of public transport with other forms of transport (e.g. buses, cars, cycles and walking). The two themes are shown to come together to produce a highly successful outcome, with this tram scheme being widely recognized

both for the pace and extent of the modal shift that has occurred. Consequently, the case study provides an excellent opportunity for students to analyse and apply the core themes identified in this Special Issue.

In the book review, *Richard Blundel* discusses an edited volume that is closely related to the subject matter of this Special Issue, *Sustainable Entrepreneurship and Social Innovation*, edited by Katerina Nicolopoulou, Mine Karatas-Ozkan, Frank Janssen and John M Jermier (Nicolopoulou et al., 2017). The reviewer notes that this experienced editorial team has assembled a varied collection of well-researched and up-to-date studies, which span several continents, including sub-Saharan African. The empirical breadth is impressive: case studies range from an examination of corporate political activity in China's emerging solar photovoltaics (PV) industry to the creation of 'entrepreneurial marine protected areas' in Tanzania, Indonesia and Belize, and the enterprising ways in which members of New Zealand's Māori community engaged with local businesses and politicians to prevent water pollution in an environmentally sensitive river catchment. This broad coverage is to be welcomed, given that contemporary environmental challenges are often experienced most acutely in the world's developing economies and by those with the most limited resources (e.g. Jamali et al., 2017; Wahga et al., 2018). For example, the WHO has pointed out that the burden of outdoor air pollution is borne disproportionately by people in low- and middle-income countries, which account for more than 80% of the 3 million premature deaths attributed to this problem annually (WHO, 2016).

Future research

The examples featured in this Special Issue reflect current practice in the pursuit of transitioning to low-carbon systems and are largely located in developed economies. However, the underlying principles and arguments in relation to the connections between governance, practices and outcomes have a much broader application and we hope that they will help to promote further work in this area, including new submissions to this journal. We conclude this introduction with some indications of future directions in green innovation research, policy and practice. Space precludes the provision of a comprehensive research agenda. However, these Special Issue contributions serve to highlight three interrelated topic areas that are likely to play a particularly important role in the next decade:

Firstly, the focus on practice that characterizes the articles presented here, has served to highlight the critical role of learning in achieving successful outcomes. Several of the cases presented demonstrate the value of *peer-to-peer learning*, in particular learning from the errors and omissions associated with earlier ventures (e.g. Killip and colleagues; Cook). While scholars often highlight the situated

and ‘sticky’ nature of knowledge, there is still a lack of applied work that is oriented towards potential solutions. Hence, there are opportunities for further research into the factors influencing learning in organizations and cross-sector collaborations, how new insights can be shared more effectively, and the ways in which skills, knowledge and understanding become incorporated into later innovation projects.

Secondly, the emphasis on *cities* found in this Special Issue provides a pointer to further research. The importance of cities to green innovation was highlighted by Fred Steward (2015) in a paper given at the first of our seminars. He drew attention to ‘Transition Cities’, such as Frankfurt, Birmingham, Bologna and Budapest, and stressed the capacity of city mayors and local governments to promote green innovation initiatives by facilitating a strategic and integrated multi-stakeholder approach. The effectiveness of city-based initiatives is clearly demonstrated in at least four of the articles presented here (Rossiter and Smith; Niewenhaus; Cook; and Disney and colleagues), indicating the potential for future research on their role as a vehicle for transitioning to a low-carbon future.

Finally, there is a considerable scope for multilevel *comparative studies* that examine the institutional structures and dynamics of green innovation in different global contexts, while also giving voice to the practitioners who are working to address serious environmental challenges and to improve living conditions around the world. This would include studies that compare and contrast the application of particular social and technological innovations in different cities and regions, as well as between different industry sectors. It could also extend to comparative research on alternative business models (e.g. Niewenhaus), forms of inter-organizational coordination (Killip and colleagues) and overarching governance arrangements (e.g. Cook; Disney and colleagues).

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2. This bullet point summary has been adapted, with acknowledgements, from the seminar presentation by Andrea Westall (Westall, 2017).

3. This issue was also raised by Charlie Wilson during the seminar series (Wilson 2017).

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