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Sustainability Research and Interactive Knowledge Generation: The Green Building Sector

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Photo: World's first living wall painting, National Gallery, London (Photo: J. Affolderbach).

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Abstract

Based on experiences from the GreenRegio research project that investigates framework conditions for innovations in sustainable/green building, this working paper explores the potential of interactive and collaborative methods for knowledge generation and co-production. Engagement with local practitioners, private industry, academics, political decision-makers and representatives of the non-profit sector early on in the research process allows researchers to gain better understanding of the research object and context. It also creates a platform for (mutual) knowledge exchange. Methodologically, the project incorporates interactive workshops and Delphi-based feedback and validation rounds, that – over the lifespan of the project – offer a mutual learning process further inspired by insights and experiences across four case studies in Europe, Australia, and Canada. The exchange and learning processes provide important insights on different forms and pathways of sustainability transitions in the building sector to all participants involved in the project, researchers and researched alike.

1. Introduction

Recent trends towards more participatory approaches in both policy-making and research – some optimistically coin it as “participatory turn” (Aldred 2010) – offer valuable tools to sustainability research. Here, the notion of “knowledge co-production”, understood as collaboration between researchers and ‘the researched’ at different stages of the research process has gained particular momentum in the social sciences. It is substantiated by arguments on the complex nature of reality compared to scientific theory (Callon 1999), practical application or “utilisation” of research (Hessels and van Lente 2008: 741; Martin 2010: 211-212) and the socially transformative stance adopted by action research (Pain 2004). It is based on the key premise that knowledge is embedded within the practices and everyday experience of all those directly involved and/or affected, including practitioners and civil society (Borg et al 2012; Bergold and Thomas 2012). As such, it challenges traditional concepts of expertise and knowledge generation, predominantly understood as a single-sided knowledge production in academia and research centres with practitioners being considered as mere recipients of scientific knowledge

produced outside their everyday realm and then “transferred” from the scientific world for application at a later stage. In contrast, participatory approaches offer promising opportunities for both the researchers and the research participants in terms of knowledge generation in general and scientific advances in particular, specifically when it comes to deliberate co-production schemes.

This is especially relevant to environmental policy and sustainability issues, which require “a scientific practice which can cope with uncertainty, with value plurality and with the decision-stakes of the various stakeholders of the problem at hand” (Hessels and van Lente 2008: 744), due to their complex and dynamic interactions with broader social, economic and physical processes (Blackstock, Kelly and Horse 2007).

In order to promote joint and collaborative approaches in sustainability research, particularly their value to understanding green innovations and sustainable transitions, we postulate complementing ‘traditional’ qualitative research methods with participative elements. We do so from a “research driven” learning and knowledge generating perspective rather than a “de-

velopment driven [with empowerment objectives] approach” (Blackstock, Kelly and Horse 2007: 729, quoting Martin and Sherington 1997:197). It differs from the more normative and social change orientation of transition management research, in which the researcher and the researched use participatory (action) research to work towards a desired change through collective goals and participative agenda building (Loorbach 2007; Wittmayer et al. 2013). We will illustrate our pledge through empirical experiences gained in the GreenRegio research project which investigates transition processes towards low-carbon economies in the building sector in four city regions: Vancouver, Freiburg, Brisbane and Luxembourg (<http://greenregio.uni.lu>).

The green building sector is an emerging, rapidly growing and promising transition field (IPCC 2014) with new actor constellations and institutional arrangements, pioneering initiatives and complex articulations between the corporate, public and civil society realms. As we seek to retrace how climate-change led innovations in the building sector occur and become mainstreamed, we are especially interested in context specific learning paths and development trajectories, key factors and actors that have been instrumental to these changes. We therefore do not limit our understanding of innovation processes to technological change and specific building projects, but deliberately chose a co-evolutionary approach taking into account interrelated organisational, procedural, legislative, and other innovations (Appendix A).

In order to grasp these complex and context sensitive relationships that describe not only the building sector but are also characteristic for sustainable transitions in many other sectors, we complemented our standard qualitative research methods with participatory approaches to knowledge creation in order to “open up

for many voices in knowledge construction” (Borg et al. 2012). This allowed us to bring together a variety of views and interpretations to analyse the phenomena under study.

In the following sections we first discuss some conceptual and methodological implications of participatory research before introducing the two collaborative methods we drew inspiration from: the “World Café” and “Delphi” techniques. We then outline potential strengths and weaknesses of the two approaches based on our own project experience. Finally, a more general conclusion is drawn discussing potential pitfalls and further opportunities for application.

2. Participatory research

The still heterogeneous collection of collaborative methodological approaches (overviews in Hessels and van Lente 2008) ranges from Triple Helix models linking academia, businesses, and public authorities over “capitalist science” searching for a short-term and tangible justification of research funding to “engaged science” following an activist agenda aimed at empowering the researched people, communities or organisations. The latter is also known as ‘participatory action research’ (PAR): “its goal is not just to describe or analyse social reality but to help change it” (Pratt 2010, quoted in Kindon 2010: 260). The approach has increasingly been applied in social sciences, including gender studies, health research and development studies, and usually focuses on inequality issues (Pain 2004). With its predominant community perspective, it is increasingly compelling for sustainability research (Carney et al. 2012). Its application promises to generate more rich and diverse knowledge that offers higher social accountability of the research in terms of transparency, problem orientation, and

tangible societal relevance. Seen as more inclusive and socially just approach, it corresponds with contemporary understandings of sustainability even though – similarly to different forms of sustainability (e.g. weak to strong) – objectives, intensity and inclusivity of participation may vary (Blackstock et al. 2007; Martin 2010).

PAR is not only a more ‘engaged’ approach to research but also requires a different attitude and behaviour on the researchers’ side, including ethical obligations regarding raised expectations and returns towards the researched community (Kindon 2010). It changes the researcher-researched relationship from generating knowledge “on” to knowledge created “with” and “by” (see Tab. 1). It also bears room for transformative reflexivity “in which both researcher and researched group reflect on their (mis)understandings and negotiate the meanings of information generated together” (Kindon 2010: 264).

Due to their complexity and diversity, sustainability transitions – whether in the building sector or elsewhere – offer a promising field of application for the “plurality of knowledges” (Newton, Parfitt 2011: 75) as advocated in PAR. In respect to our research project, we were challenged with the task of gaining a detailed understanding of the sustainable building context in each of the studied cities, looking at the respective achievements and agendas of different public, private and non-governmental institutions in order to be able to actually identify and map factors of the on-going transition. While our initial approach relied on documentary analysis, our need to access a large range of actors familiar with the context of sustainable building and to grasp the more diffuse relationships and connexions between them drew us towards more collaborative and interactive research methods.

Table 1: Researcher-researched relationships within participatory research

Attitude of researcher and example of attitude reflected in what researcher might say to researched group (RG)	Relationship between researcher and researched group (RG)	Mode of participation	Relationship between research and researched group (RG)
Elitist <i>'Trust me and leave it to me, I know best.'</i>	Researcher designs and carries out research; RG representatives chosen but largely uninvolved; no real power-sharing.	Co-option	ON
Patronizing <i>'Work with me. I know how to help.'</i> (i.e., I know best.)	Researcher decides on agenda and directs the research; tasks are assigned to RG representatives with incentives; no real power sharing.	Compliance	ON/FOR
Well-meaning <i>'Tell me what you think, then I'll analyze the information and give you recommendations.'</i> (i.e., I know best.)	Researcher seeks RG opinions but then analyzes and decides on best course of action independently; limiting power-sharing.	Consultation	FOR/WITH
Respectful <i>'What is important to you in the research? How about we do it together? Here's my suggestion about how we might go about this.'</i>	Researcher and RG determine priorities, but responsibility rests with researcher to direct the process; some power-sharing.	Cooperation	WITH
Facilitative <i>'What does this mean for you? How might we do the research together? How can I support you to change your situation?'</i>	Researcher and RG share knowledge, create new understandings, and work together to form action plans; power-sharing.	Co-learning	WITH/BY
Hands-off <i>'Let me know if and how you need me.'</i>	RG sets their own agenda and carries it out with or without researcher; some power-sharing	Collective action	BY

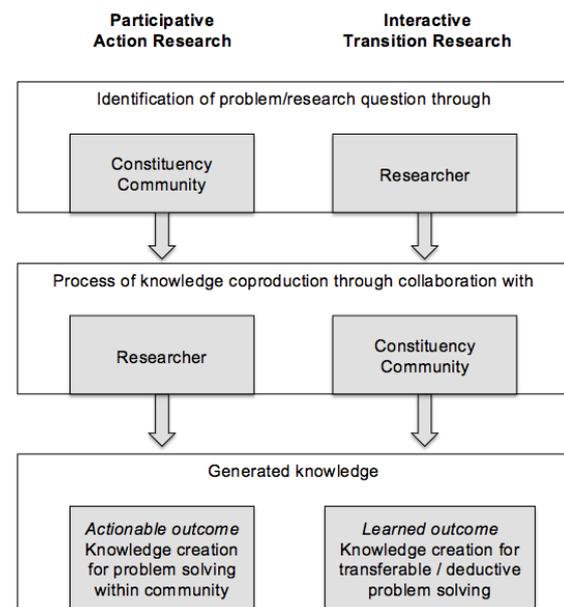
PAR's principles in terms of research perspective and understanding of the studied actors' role in knowledge production stimulated our project approach. More precisely, we drew inspiration from PAR in terms of its notions of "cooperation" and "co-learning" (see Tab. 1) to actively involve the researched group in both the conception and scoping of our empirical work as well as in the generation and validation of new knowledge. Other than PAR in its original normative sense where researchers are joining particular communities with which they co-produce knowledge to serve practical needs, we started from an inverse logic (Fig. 1). Drawing on the proposed World Café and Delphi methods, we invited a wide range of local experts, including practitioners and scholars in the action field of green building, to join us, the researchers, in our endeavour to shed more light on the various facets and underlying mechanisms of sustainable building in the four case study regions, and notably:

- to gather different understandings of the transition towards sustainable building,
- to identify common patterns in terms of particularly significant factors,
- to capture tacit knowledge, harder to grasp through document analysis.

In this constellation, the researched group turns from an "object" of study or key source of information to a collaborating partner who co-creates new knowledge while interacting with the researchers but also through exchange within the researched group. This allowed us to establish a positive contact with what Sheridan et al. (2010: 34) call "local intelligence" in a way that would avoid feelings of "unreciprocal [...] processes of knowledge extraction" (Newton and Parfitt 2011: 76). We are fully aware of PAR frequently being criticized for its "value-ladenness" (Weingart 1997) and the potential prob-

lems related to "language" incompatibilities between researchers and practitioners (Kieser and Leiner 2012). Nevertheless, we see promising collaborative tools that allow to reach further than with traditional interview or focus group techniques when tackling sustainable development policies, while at the same time keeping in mind that "they are not a substitute for more in-depth social research methods" (Kindon 2010: 272).

Figure 1: Participative Approach in Transition Research



2.1 The World Café

One of the methods we used to co-produce knowledge with our researched community and inspired from PAR principles was to host World Café events with a range of local sustainable building practitioners. The method has been developed in the mid-1990s by Juanita Brown and David Isaacs (<http://www.theworld-cafe.com/history.html>) and consists in a group intervention that encourages an open dialogue between participants by relying on unconstrained and interactive conversations. It is operationalised by splitting participants across tables of four to five participants (The World Café 2008) where they are invited to tackle a specific

question. Participants are then progressing through several conversation rounds with additional questions, as they are asked to circulate and mix across the different tables (The World Café 2008). The content of each conversation round is further retained and passed on to the next group by a fixed table host, and eventually complemented by a final plenary discussion to ensure sharing and connecting of the generated information amongst the totality of participants. This “recombination” of knowledge (Brown 2001: 3) generates reflexive processes amongst participants, progressively leading to the emergence of shared patterns. The group’s collective understanding of an issue can thus be mobilised, including tacit knowledge, while allowing a sense of ownership of the results (Brown 2001; Fouché and Light 2011; Prewitt 2011).

The originality to other group interventions lies within the method’s attempt to convey the atmosphere of a café setting through the use of symbolic items like tablecloths, the availability of drinks and food, or even more playful tools as the possibility to write or visualise ideas directly on paper tablecloths. This “framing” aims at encouraging participants to act as they would during an informal and relaxed meeting at a café (Jorgenson and Steier 2013). Such setting is sought to enhance the dialogic process of “shar[ing] openly, listen[ing] without judgement and [...] accept[ing] diverse opinions” rather than mere discussions, whose “purpose [...] is to make a point, convince others or win a verbal battle” (Prewitt 2011: 190-191).

With the exception of a few reflexive discussions (Aldred 2010; Prewitt 2011; Jorgenson and Steier 2013), the relatively low number of publications on the Café method mainly revolves around descriptive insights on its application within the framework of specific projects, leaving the reader with a rather “fragmented” (Aldred

2010: 57) and patchy impression: World Cafés are used by various types of public, private, and non-governmental organisations (<http://www.theworldcafe.com/impact.html>) in rather different contexts for very diverse purposes including learning (Anderson 2011), empowering communities (Sheridan et al. 2010; Fouché and Light 2011; for a critical discussion see also Aldred 2010), facilitating collaboration and communication within an organisation (Tan and Brown 2005; Prewitt 2011), stimulating innovation, networking and relationship building (Fouché and Light 2011), or even to improve sales of a product (Aldred 2010: 68, quoting Brown and Isaacs 2005: 31).

This confusion is even further reinforced by the different labels in use to designate variations of the method, including for instance the Knowledge Café, Conversation Café or Innovation Café, while some organisers even individually craft names intended to fit a specific topic (Prewitt 2011). If these differentiated applications might highlight the method’s success amongst practitioners, they are also characteristic of its appropriation by what Aldred (2010: 62) calls the “participation industry”.

Despite these critiques and reflecting on our experience with the method, we would like to advocate for a flexible use of different ‘Café-inspired’ research methods, as long as its key premise and objectives are respected. Our argumentation is twofold, revolving first around the sharing of the method’s philosophical premise between all these diverse usages. We then would like to pragmatically argue in favour of the method’s contextual adaptability to different research and practice objectives by underlining the richness of potential follow-up utilisations of Café results for researcher and researched alike.

The core justification for using the method resides in its potential to encourage effective participation of a diversity of participants by breaking with their cognitive understanding of usual meeting forms (Prewitt 2011; Jorgenson and Steier 2013). This can be considered to be the common denominator of the different usages of 'Café-style' methods found across the literature. It indeed allows "ordinary interactional routines [to be] suspended" (Jorgenson and Steier 2013: 390), most notably hierarchical relationships (e.g. Tan and Brown's (2005) account of the use of World Cafés within the Singapore Police Force), opening the way towards more diversified, inclusive, and changing understandings of a specific topic. While collective processes of learning and knowledge sharing lie at the heart of 'Café-inspired' methods, it is important to be aware that these methods are rooted in constructivist philosophy. The aim of using such group intervention is to seek the diversity of perspectives held by the involved participants, thus "construct[ing] distinctive versions of the 'lay views' [rather than] over-stating consensuality" (Aldred 2010: 62-63). Our second line of argumentation revolves around the possibility to further trigger highly practical and contextually adaptable actionable outcomes for researcher and researched alike when engaging with the Café's four main objectives: constructive dialogue, relationship building, collective discoveries, and collaborative learning. In that perspective, we join Fouché and Light's (2011: 41-45) pledge to open up the discussion to the "value" of the World Café.

Constructive dialogue opens access to more tacit forms of knowledge offering an effective way to collect data (Fouché and Light 2011: 34), which is the focus chosen in the Knowledge Café variation (<http://www.gurteen.com>). Bringing together a diverse population with shared interest in specific topics can eventually

have integrative effects on participants, fostering the emergence of a shared culture in an organisation or initiating the building of networks and connexions useful to a specific community. Collective discoveries through "cross-pollinating" ideas (Tan and Brown 2005: 84) and identifying larger patterns might for instance lead towards the emergence of innovative solutions or ease the way towards later consensus building. Finally, collaborative learning through sharing insights might offer interesting potentials in terms of capacity building.

2.2 Delphi

The Delphi approach shows a series of similarities to the World Café workshops (e.g. interactive approach, composition of expert panels). Technically speaking, its main difference can be found in its incremental, usually two-stage approach aimed at validating findings from previous rounds of data collection. In methodological terms, the Delphi approach was initially motivated by the search for reliable forecasting techniques in areas of limited knowledge (e.g. technological risks, marketing studies), as a decision-making tool ("policy Delphi") or as a consensus-making procedure among stakeholders (see Evrard et al. 2014). Given the variety of uses, Rowe and Wright (2011: 1489) prefer talking about "Delphi techniques" instead of a single "Delphi method". The common idea of the various applications is "to obtain a reliable group opinion from a set of experts" (Landeta et al. 2011: 1630), be it for scenario building (forecast) or be it for the validation of research results. In both cases, the researchers filter and categorise information obtained to give expert panels the opportunity to comment on preliminary results and to discuss the most intriguing aspects in more depth. Usually both rounds are run anonymously, but openings

towards more interactive formats are becoming more frequent.

The use of Delphi techniques in the socio-environmental sciences has so far been

Table 3: Composition and themes of the GreenRegio project world Café workshops

Case study region	Date of workshop	Number of participants	Sectors represented/affiliations	Discussion topics
Vancouver	Nov. 8, 2013	14	Architect, engineer and design firms, developers, think tanks, research institutes, NGOs, municipality, energy provider	1. Actors and institutions 2. Framework conditions 3. Key projects
Luxembourg	Jan. 29, 2014	27	Architect, engineer and design firms, private and public developers, interest and professional associations, research institutes, NGOs, ministries (sustainability, economy, housing), energy consultancy	1. Actors and institutions 2. Framework conditions 3. Key projects 4. Challenges and barriers
Freiburg	Feb. 12, 2014	10	Architect, engineer and design firms, public developers, research institutes, municipality, energy provider	1. Actors and institutions 2. Framework conditions 3. Key projects 4. Challenges and barriers
Brisbane	Mar. 27, 2014	10	Architect, engineer and design firms, research institutes, NGOs, municipality, ministry, regional administration	1. Actors and institutions 2. Framework conditions 3. Key projects 4. Challenges and barriers

relatively limited. Among the exceptions are the so-called “spatial Delphis” that use mental maps and interactive GIS techniques to collaboratively gather expert knowledge about spatial phenomena, environmental impacts, territorial trends and related development strategies (Balram et al. 2003, Vargas-Moreno 2008, Evrard et al. 2014). Since the territorial dimension is less relevant to our research, we drew more inspiration from more orthodox Delphi techniques, which, over the last years, have been applied in multiple fields and in a very flexible manner. They also allow the combination with other methods such as focus groups, interviews, or document analysis. For example, Landeta et al. (2011: 1631-37) propose a “Hybrid Delphi” when combining face-to-face exploration via focus groups with a more formalized two-stages Delphi based on questionnaires (non face-to-face).

3. Applying participatory elements in research: Return on experience

To initiate contact as well as to involve as many experts’ voices as possible, we began our field research by organising four successive workshops inspired by the World Café and Delphi techniques. For each, we set up three discussion rounds, each one focused on a specific dimension of the sustainable building sector following the project’s co-evolutionary approach: actors and organisations, building projects and framework conditions (encompassing institutional aspects like legislation, socio-economic aspects, etc.). Following returns on the first Café experience, we further added a fourth discussion table addressing challenges and barriers to the development of sustainable building practices, as it had been an important and recurring topic of exchange amongst participants (Table 3).

We sometimes encountered difficulties for interactive dialogue and shared understanding to emerge at some of the tables, where participants' contributions remained quite detached from each other's. Some participants even expressed the feeling of having repeated themselves between the successive rounds. This might be related to our choice of topics and questions implying quite descriptive and informative responses. Several authors insist therefore on the importance of carefully crafting the Café's questions (Brown 2001; Prewitt 2011), as well as of facilitation skills of the Café's host(s), in order to deal with group dynamic (Prewitt 2011). The maturity of the community dealing with the subject at stake during the Café might also be given explanatory power, as we noticed stronger dynamics at work within the two case studies with a longer record of climate change mitigation within the building sector.

World Café workshop discussions in Freiburg

(Photo: Carolin Hulke)



We followed up on the World Café exchange with our experts through the dissemination of a report summarising the main outcomes to the participants in form of a Delphi-inspired questionnaire, where we asked them to critically re-assess and validate the transition factors that emerged from the World Café. We then used the information as guidance to determine a number of key aspects for in-depth qualitative micro case studies in each of the four cities, covering selected green building policies and programmes, influential or-

ganisations and actors as well as built environment projects. This step is backed through document analysis and semi-directive interviews. The World Cafés further provided us with access to relevant interview partners, necessary background knowledge and references. Outcomes and results of these steps are foreseen to be presented to the same group of experts towards the end of the research projects through a second Delphi-round, notably to critically assess, review and validate findings, but also to disseminate and ensure transmission of the results to eventually allow further utilisation within the researched community.

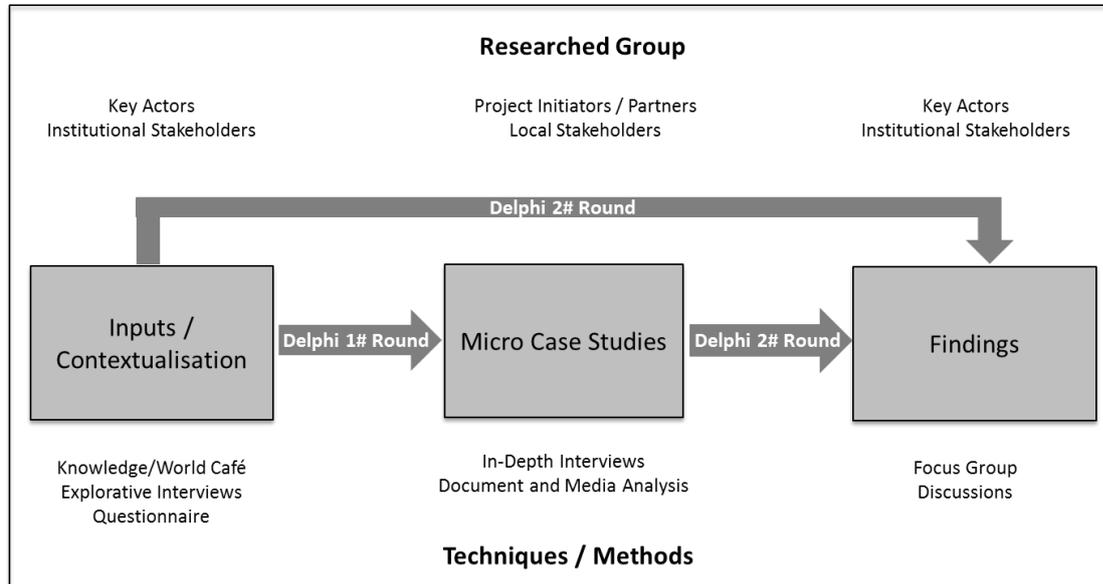
Obviously, such an approach requires a high commitment of the participants and their availability over the project's life span. In order to facilitate buy-in to our research endeavour, participants of the first Delphi round have been invited to join the project's scientific advisory board. Its members are informed about the project's advances and solicited when strategic decisions have to be taken, major methodological problems have to be overcome and when preliminary findings are available for evaluation.

We thus use the World Café and Delphi not only as a first step to gather a large amount of information but also as accompanying and strengthening framework for subsequent micro case studies and their in-depth analysis (Appendix A). Further, we rely on the techniques to gather, filter, and analyse findings, which – together with the outcome of the micro-case studies – are then resubmitted to participating experts and become subject to critical discussion. Consequently, our research design combines and complements elements of two participatory methods with more "orthodox" qualitative research methods (Figure 3). This incremental procedure, and particularly the second Delphi round is designed to assure a high level of reflexivi-

ty both of the researchers as well as the researched group. Hence the latter's most pertinent role probably lies in critically re-

flecting on shared knowledge and validating final interpretations of our analysis.

Figure 3: Research approach used in the GreenRegio project



4. Discussion and Outlook

Using co-productive elements in our research design definitively proved an effective way to get relatively quick access to a large amount of information, including more reflexive and self-critical aspects from the participating experts, which were prompted by the dialogic interactions of the World Café and might have been less easy to assess otherwise. Even though we initially introduced the World Cafés as interactive ways of generating rich and diverse knowledge, the events proved to be truly collaborative, as they were mutually beneficial for us and the researched group alike. In one of our case studies, the relatively novel emergence of the sector involves a large number of actors, without clear organizational patterns and established networks yet. In this case, Café participants were especially keen on discussing obstacles to green building transitions and used the event as an exchange platform to bring together positions and formulate action points, thus allowing capacity

building amongst participants as well as the production of actionable knowledge. Similarly, in two cities considered as leaders in green building transitions, the dialogic and unconstrained atmosphere of the event triggered reflexions within the already well connected practitioners' community on the need for renewal and strengthening of sustainable building practices within the city regions, for instance through increased social benefits. In general, participants reflected very positively on networking and opportunities to connect provided through the Café events.

One crucial aspect to consider in respect to collaborative research elements relates to the selection and representativeness of participants (see discussions in Bergold and Thomas 2012; Pain 2004). Although we sought to invite actors with different expertise and constituencies actual participation in terms of numbers and diversity of interest groups varied. Notwithstanding our efforts, certain stakeholders proved difficult to engage with, for instance the non-governmental sector in one of our

case study regions. If this relates to an over-solicitation of certain interests in that particular city region, it definitively sets limits regarding the representativeness of generated input, despite the method's participative and constructivist premises, thus rejoining traditional issues related to the practice of participation in policy-making. Similarly, and as already evoked earlier, the ability for researchers using collaborative research approaches to facilitate and mediate should not be underestimated, in order to ensure the discussion stays truly open to everyone. For instance in group interventions where some participants tend to dominate more easily the conversation and leave less room for expression to others, one way the World Café offers to circumvent such power inequalities is through encouraging participants to move across tables, thus meeting other participants with which they can interact differently. Our follow up through a Delphi-inspired questionnaire of the World Café also further opened up another possibility for participants to express aspects they might not have had the chance to during the event.

While participatory (action) research is focused on problem-solving through identifying ideal scenarios (e.g. Delphi), community-building and actionable outcomes ready to be applied, an interactive research-driven approach seeks to provide knowledge and understanding for future decision-making challenges. We believe that collaborative methods have particularly much to offer when seeking to unravel the complex drivers and processes behind sustainability transitions that inevitably involve a wide range of (at times contested) interests and stakes. While our research design was originally driven by an interest in knowledge production from a research perspective, our project experience confirms mutual benefits for researchers and researched groups alike with an opportunity to learn and reflect on

coproduced diverse knowledge(s) in changed researcher-researched relationships. Interactive research can offer numerous tangible benefits including new platforms of knowledge exchange, stimulation for reflexions and cross-pollination as well as higher validity of findings through numerous feedback loops between researchers and researched.

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Appendix A - Potential micro-case studies identified for the four case study regions based on workshop input and feedback rounds

	Vancouver	Luxembourg	Freiburg	Brisbane
<p>Policies and Frameworks</p> <p>Document & media analysis, semi-structured interviews.</p>	<p>(a) Greenest City 2020 Action Plan & building bylaws: sustainability vision published in 2011 by the City of Vancouver with the goal to become the world's greenest city by 2020. Green building is one of the 10 identified themes with two identified medium-term goals to be achieved by 2020: (1) all new buildings to be carbon neutral and (2) the energy efficiency of existing buildings to be 20% below 2007 levels. To realize the goals, the city has introduced a number of tools:</p> <ul style="list-style-type: none"> - Vancouver green building code: including the highest energy standards in North America - Green building policy for rezoning - Rezoning policy for large scale developments - Policy for higher buildings 	<p>(a) Policies & programs of the Ministry of Economy and Foreign Trade concerning Ecoinnovation & Energy savings (incl. funding schemes and legislation)</p> <p>(b) Building certification:</p> <ul style="list-style-type: none"> - LUNAZ: nationally developed sustainability certification standard for residential buildings - Implementation and use of different certification schemes (DGNB, BREEAM, LEEDS, HQE, etc.) <p>(c) Vocational training:</p> <ul style="list-style-type: none"> - Publicly funded and private professional training - National qualification initiative LuxBuild 2020 which – as part of the European „Build Up Skills Initiative“ – develops a training strategy for craftsmen in the building sector in order to help achieve the European 20-20-20 goals and corresponding national objectives. 	<p>(a) Climate action plan of the City of Freiburg: Action plan developed in 1996 by the City of Freiburg in order to significantly reduce CO₂ emissions and subsequently updated in 2007 and again in 2011, following an evaluation study by the Öko-Institut. One central aspect concerns the energy efficiency of buildings.</p> <p>(b) Freiburg's new building standards: introduced in 1992 and regularly updated standards for low energy constructions. Stricter than national standards, the Freiburger Standards are currently in line with the KfW standards (publicly owned reconstruction credit institute) for housing financing. They were generalised following positive experience in the low-carbon neighbourhoods' developments of Rieselfeld and Vauban.</p> <p>(c) Energy consultancy through the energy provider Badenova (previously: Stadtwerke FEW) and Energieagentur Regio Freiburg.</p>	<p>(a) City smart: Brisbane City Council initiative aimed at transforming Brisbane into Australia's most sustainable city. Since 2007, individual developments are planned in collaboration between private and public actors including a District Cooling System (DCS) for Brisbane's Central Business District.</p> <p>(b) Sustainable development grants: "Brisbane City Council's Sustainable Development Grants for Offices" was awarded between 2007 and 2009 for energy efficient office buildings in Brisbane.</p> <p>(c) Climate Smart 2050 - Queensland climate change strategy 2007: Comprehensive sustainability programme by the Queensland government prescribing, for example, stricter energy efficiency for all new public buildings.</p>

	Vancouver	Luxembourg	Freiburg	Brisbane
<p>Organizations and actors Document analysis (incl. internet-presentation), semi-structured interviews, participation in events and participatory observation</p>	<p>(b) LightHouse: non-for-profit company providing research, advisory and project management services in green building and sustainable infrastructure to businesses, private households and policy makers.</p> <p>(c) University of British Columbia: pioneer and international leader in sustainable building in research and implementation, including one of the world's first sustainable buildings (1996) and the Centre for Interactive Research on Sustainability (CIRS) opened in 2011 which advances knowledge in sustainable building and urban planning internationally.</p>	<p>(d) Neobuild: publicly funded initiative launched by the construction sector to establish an exchange platform for SMEs around research and development in sustainable building.</p> <p>(e) Resource Centre for Environmental Technologies (CRTE): section of the national research centre Henri Tudor, specialized on environmental technology and life cycle analysis, e.g. for building materials.</p> <p>(f) MyEnergy: publicly funded agency providing energy consultations to private households, enterprises, and municipalities (Klimapakt). Organizes a yearly trade show on energy efficient retrofits.</p>	<p>(d) Energy agency Regio Freiburg: private corporation (GmbH). Shareholders include the City, a local trade association and a renewable energy association. It offers consultancy services on energy efficiency and renewable energy. The agency is involved in several energy efficient and model building projects bringing together public and private actors from the Freiburg region.</p> <p>(e) Freiburger Stadtbau: municipal housing society and largest landlord in the region which plays a key role in the mainstreaming and adoption of the 'Freiburg new building Standard'.</p> <p>(f) Fraunhofer Institute for Solar Energy Systems (ISE): research institute for energy efficiency and "green" technologies active in a number of pioneer projects in Freiburg including a self sufficient solar house in 1986, scientific guidance in retrofitting of high-rise buildings to passive house standards in Weingarten West since 2009 and 'Energie-Quartier Haslach' since 2013.</p>	<p>(d) Green Building Council of Australia: central actor involved in the development of regulatory frameworks for sustainable buildings in Australia and founder of the „Green Star“ certification system.</p> <p>(e) Australian Sustainable Built Environment Council (AS-BEC): Governing body of key actors in sustainable building including representatives from industry and trade associations, NGO and government institutions.</p> <p>(f) Property Council of Australia: Lobby of the property industry (investors, property owners, developers, professionals).</p> <p>(g) Urban Development Institute of Australia (UDIA): Lobby of the property industry that awards the EnviroDevelopment rating system.</p>

	Vancouver	Luxembourg	Freiburg	Brisbane
Building projects Document analysis, semi-structured interviews, site visits	<p>(d) South East False Creek: sustainable neighbourhood developed on an old-industrial site to house the athletes of the 2010 Winter Olympics. It was the first development to gain LEED Platinum neighbourhood certification based on strict sustainability criteria including integration in the public transportation system and mixed use.</p> <p>(e) Mall redevelopment & rezoning: different projects based on rezoning of existing retail areas to mixed use including alternative mobility concepts.</p> <p>(f) Community Housing Mole Hill: joined renovations in 1999 to 2003 of a historical downtown block incorporating environmental (recycled materials, geothermic, reduced parking and social (social housing) sustainability goals.</p>	<p>(g) Solarwind, Windhof: completed in 2012, the office building gained triple-certification (HQE, DGNB, BREEAM), implemented “cradle-to-cradle” principles for interior design, as well as integrates different pedagogical approaches.</p> <p>(h) Hollerich Village: privately planned sustainable neighbourhood project to be developed on a brownfield site in the city of Luxembourg. The project aims at following the British „One Planet“ principles by NGO BioRegional (involved in the BedZed project in London).</p> <p>(i) Neobuild Innovation Centre: initiated by the building sector (through the platform Neobuild), the modular passive building strongly focuses on technologies, demonstration, and learning, notably by offering local business opportunities to showcase innovative sustainable building solutions.</p> <p>(j) Nei Schmelz – Dudelange: planned sustainable neighbourhood project on an old brownfield site of the steel industry. Promoted by a national public developer and the Luxembourgish Eco-Innovation Cluster as model project for ecotechnologies.</p>	<p>(g) Weingarten West: neighbourhood entitled to funding from the national „Soziale Stadt“ (social city) renovation program. In cooperation with the energy provider Badenova and the Fraunhofer Institute, the Freiburger Stadtbau retrofitted several high-rise buildings from the 1960s to passive house standards. Public participation of the tenants has also been an important aspect of the projects.</p> <p>(h) Rieselfeld & Vauban: low-carbon model neighbourhoods. The City enacted low energy building standards via the land sales and through small plot planning favouring building cooperatives.</p> <p>(i) Energiequartier Haslach: neighbourhood project aimed at encouraging energy efficient retrofits through advice and documentation of selected model retrofit projects.</p>	<p>(h) Lady Cilento Children’s Hospital: publicly planned and financed model project by the Queensland government in energy efficiency.</p> <p>(i) Brisbane Square: completed in 2006 and housing Brisbane City Council and Brisbane Square Library, the complex is one of Brisbane’s first ‘green buildings’ and the first in Australia to be accredited 5 Green Stars.</p> <p>(j) The Green: sustainable housing project as part of an extensive urban renewal program in Showground Hill, Brisbane.</p> <p>(k) Botanica Residences: first sustainable residential high-rise (180 units) to be awarded EnviroDevelopment certification by the UDIA in 2013 featuring façade solar panels.</p> <p>(l) Green Square: mixed use buildings in Fortitude Valley which constitute a milestone in Brisbane’s development strategy with an emphasis on social sustainability (affordability) including one building achieving the highest Green Star rating of 6.</p>