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ORIGINAL ARTICLE

Disasters as opportunities for sustainability: the case of Christchurch, Aotearoa New Zealand

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Abstract

Disasters can catalyze change in different ways, among others: they allow reinforcing pre-disaster exploitation and inequities, enhancing disaster risk reduction policies, or introducing alternative pathways guided by sustainability. Only few studies have investigated the latter: how people were able to leverage disasters for change towards sustainability. This study deals with such people who were able to see, seize, and sustain opportunities for sustainability following a disaster. The study generated data through semi-structured interviews with sustainability change agents in Christchurch, Aotearoa New Zealand, active during and after the major earthquakes period 2010–2012. The study finds that progress towards sustainability to date is mixed. While Christchurch was less successful in leveraging the immediate opportunities for sweeping change towards sustainability, the sustainability change agents continued to see, seize, and sustain post-disaster opportunities to move sustainability forward. The study derives advice on how to best leverage disasters for sustainability.

Keywords Sustainability · Disaster · Opportunity · Change · Agency · Christchurch

Introduction

Disasters and post-disaster recovery processes provide windows of opportunity for change (Birkmann et al. 2009; Pelling and Dill 2010; Solecki 2015; Wiek et al. 2015). Human agency is needed to recognize and leverage such windows of opportunity. The majority of studies document post-disaster change that benefits interest groups at the expense of the greater good (e.g., Klein 2007; Gunewardena and Schuller 2008; Gotham and Greenburg 2008). In contrast, there is a body of work that evaluates to what extent disasters spur disaster risk reduction measures and building back better efforts, enhancing resilience. These efforts primarily focus on mitigating potential impacts of future hazards while improving disaster recovery (Pantuliano et al. 2014; Mannakkara 2014). To expand these efforts, the notion of building back better needs to include not just building back "stronger", but also "greener" and "more equitably" (Kim and Olshansky 2015). Others go even further, arguing that there should be no building *back* better, but building differently to enable bouncing forward to a sustainable future (Manyena et al. 2011; IOM 2015). Few studies document, how individuals and organizations seized windows of opportunity for social cohesion and justice, renewable energy and resource-efficient construction, and integrated livelihoods (e.g., Solnit 2009; Swearingen-White 2010; McSweeney and Coomes 2011). Investigating "the positive side of disasters" supports communities in how to utilize disastrous events to make progress towards sustainability (Agrawal 2011). Such research becomes important as "every extreme event should be seen as an opportunity for learning" (Solecki 2015, p. 9). This will enhance capacities for sustainability, disaster risk reduction, and adaption.

The city of Christchurch in Aotearoa New Zealand is one of the cases, where civil society, businesses, and some government entities desired to seize opportunities for change towards sustainability after the series of earthquakes 2010–2012. After more than 5 years of recovery efforts, an open question is: did Christchurch seize the opportunity for

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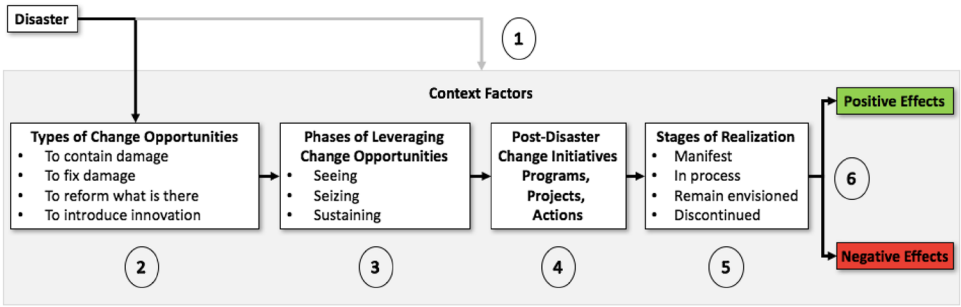

Fig. 1 Disasters present opportunities for change, which agents leverage to design post-disaster change initiatives, some manifest in positive sustainability outcomes, while others manifest in negative impacts on sustainability. Contextual factors influence all stages of the process

change towards sustainability, or did it miss it? The answers shape people's outlook on future opportunities for the remaining "regeneration phase".

Considering the tension between opportunities missed and seized during the Christchurch disaster recovery, this study addressed the following research questions:

1. Which context factors influenced leveraging post-disaster opportunities for change actions (towards sustainability)?
2. What opportunities did the disaster offer?
3. What were the main mechanisms of leveraging the opportunities, i.e., practices and attributes of the change agents?
4. What specific post-disaster change actions were undertaken?
5. What was the stage of outcome realization of the leveraged opportunities (towards sustainability)?
6. To what extent did they positively or negatively impact sustainability?

The study offers insights on how change towards sustainability can be strengthened in places affected by disaster.

Research design

To analyze the research questions, I developed a framework (Fig. 1) synthesizing literature from disaster research and sustainability science (Brundiers 2016). The framework draws on concepts of change in *disaster*, such as the pressure-release model (Wisner et al. 2004), windows of opportunity (Birkmann et al. 2009; Pelling and Dill 2010; Westley et al. 2013), and long-term recovery with its complexities and uncertainties (Wise et al. 2014). Conceptualizing change towards *sustainability*, the framework draws on transformative agency of actors, and how they collaborate in transition arenas or shadow networks (Olsson et al. 2006; Loorbach 2010; Westley et al. 2013). It adopts a normative and solution-oriented perspective from sustainability science aiming to understand how *people* are able to pursue change towards sustainability (Sarewitz et al. 2012; Miller et al. 2014). The framework finally identifies effects in daily activity fields (Kahneman et al. 2004)[1] that are related to sustainability (Forrest and Wiek 2014). These effects emerge from change initiatives, programs, projects, and actions as well as contextual factors. Contextual factors influence people's actions in enabling and constraining ways (Giddens 1984). The framework also entails a *sustainability "plus" appraisal* to evaluate the *sustainability effects*, "plus" the *extent* of these effects. I used Gibson's (2006) sustainability criteria, adapted them to disaster recovery, and determined whether effects are enhancing (green) or decreasing (red) sustainability (Brundiers 2016). Next, I used a four-point scale to appraise four additional criteria that inform about the *extent* of the effects: the type of opportunity, the stage of realization, the geographical spread (city, province, country, and international areas), and the effects on sustainability change agents' power position. The overall scores were normalized on a ± 1–10 scale and color-coded in red and green (Fig. 4). Effects on agents' power position result from their efforts to realize sustainability initiatives (c.f., Avelino and Rotmans 2009; Partzsch 2015). Effects include: (1) power position remained the same, or power position increased as agents *gained*: (2) allies and effective participation in networks; (3) resources (funds, savvy, legal support) and ability to employ them; (4) authority and weight in decision-making processes. Zero points indicate a loss of power. Figure 1 illustrates the framework used to organize the research questions and results.

The research focuses on perspectives and insights from *change agents*. First, transition literature postulates that for micro-scale initiatives, as in Christchurch, "motives and strategies of actors on the ground are critical to making transitions socially-robust and sustainable" (Turnheim

[1] Daily activity fields include: housing, working, educating, eating, shopping, recreating, worshipping, engaging, caring, communicating, and being mobile. This research insufficiently addresses the fields of shopping and worshipping as they were less emphasized in the interviews. Caring includes caring for people and for the environment. In Māori culture people are the land and the land are people. Recently, this translated into law, with river systems being legally defined as a person (Rousseau 2016).

et al. 2015, p. 244). The agents' perspective is especially relevant in Christchurch as many of the sustainability initiatives pushed back against neoliberal policies implemented by central government. Second, in their efforts to institutionalize new practices, agents need to work with others across different levels of governance, including their constituencies, supporters, and opponents (Fischer and Newig 2016). Thus, the reported perspectives of agents do, albeit indirectly, reflect the perspectives of these other groups and the influencing role of context.

Fieldwork was undertaken in Christchurch, Aotearoa New Zealand from January to April 2015 and included 60 semi-structured interviews. 46 of them were conducted with people *leading* sustainability initiatives. Site visits and public engagement events offered opportunities to discuss preliminary research insights. Contacts were identified through the snowball method, accounting for initiatives in different sectors (public, private, and third sector), daily activity fields, and with comprehensive or select sustainability goals.[2] Initiatives with select sustainability goals focused e.g., on mental health, democratic governance, or renewable energy; those with a comprehensive notion supported actions that equally considered social, economic, and environmental needs. I use the term "agents" as shorthand to refer to the leaders of sustainability initiatives that attempted to leverage the post-disaster situation to advance sustainability. The research design was approved by the institutional review board at Arizona State University.

Results

Context challenges for leveraging opportunities for sustainability in Christchurch

This section describes pre-disaster, disaster, and post-disaster contexts that influenced change agent's sustainability work (cf. Fig. 1).

Pre-disaster situation

Some of the issues that made Christchurch one of the "most political disasters" (CC_47)[3] originated in the pre-disaster context. These include a central government, led by a center-right party, that expanded neoliberal approaches to economic development (Jones 2016). Its top–down approaches chiseled away democratic governance institutions. For instance, in natural resource management with water being a highly-contested resource, central government suspended regional government elections and appointed expert commissioners, despite local and legal objections (Hayward and Cretney 2014). Another harbinger was that central government cut the word sustainability out of documents, narrowing it to resilience (CC_50).

On a local level, many respondents perceived a rich–poor divide in Christchurch manifesting in a housing crisis (CC_56; McCrone 2013). As the central government left housing provisioning to market forces, finding affordable and safe housing was difficult post-disaster, especially for vulnerable populations (Howden-Chapman et al. 2014; Hayward 2013). Long-standing inequalities were aggravated through budget cuts to service providers for mental and physical well-being, many of them third sector organizations (Horn et al. 2015).

Preparedness for disaster recovery was weakened as laws requesting buildings to be strengthened were lax, and city council had reduced its insurance premium (Sheppard 2014). On a national level, the reform of the Civil Defense and Emergency Management Act in 2002 proposed including sustainability principles and devolution of power. Subsidiary boards, however, were reluctant to take on such responsibilities and re-delegated some power back to the crown (CC_2).

Disaster situation

The first earthquake occurred on September 4, 2010 (Magnitude 7.1); yet, it was the second major earthquake on February 22, 2011 that altered the face of the city (Magnitude 6.3). Its impacts resulted in 185 deaths, traumatic injuries, and destroyed houses, businesses, schools, churches, recreational facilities, infrastructures, ecosystems, Māori's settlements, and places of community gatherings. Rock falls and subsidence changed the geology, topography, and ecosystems in greater Christchurch and soil liquefaction inundated suburbs across Christchurch. Particularly affected were the low-income communities in East Christchurch and affluent suburbs of Sumner and Mount Pleasant (Hayward and Cretney 2014). Impacts also resulted in the designation of a "Residential Red Zone", requiring the residents to abandon their homes. Almost 8000 properties needed to be demolished and their inhabitants relocated (Toomey 2012). Downtown Christchurch had to be evacuated and was cordoned off for more than a year because of safety and demolition issues (Stevenson et al. 2014). The downtown cordon combined with the destroyed road system pushed people and enterprises to the North and West of town. This altered travel patterns and caused passenger losses in public transport (Koorey 2014). 59 earthquakes of magnitude 5 or

[2] Third Sector Organizations (TSO) is the term often used in Aotearoa New Zealand to describe organizations that are neither statutory nor commercial entities; they include non-for-profit, non-governmental, and civil society organizations.

[3] This is the format for identification of interviewees. They are anonymized, but I have provided brief descriptions of respondents' positions, organizations, and locations of work in the appendix.

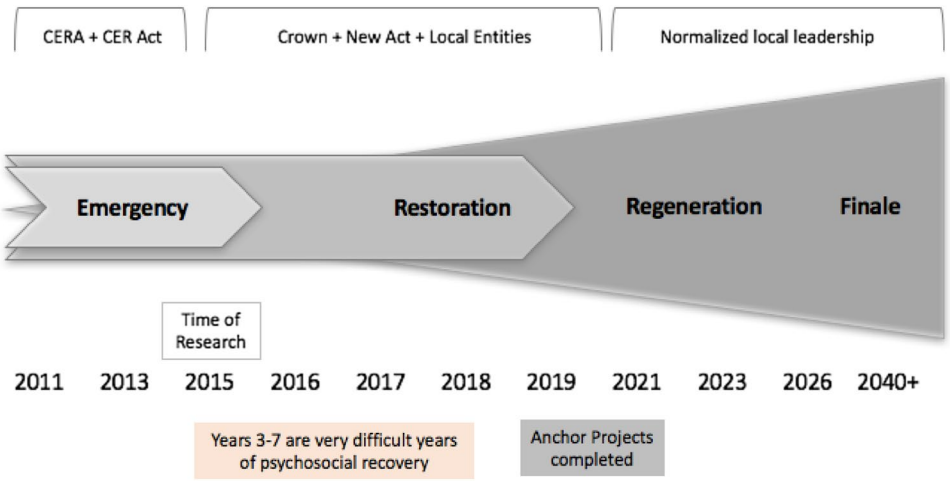

Fig. 2 Disaster recovery phases of the Canterbury earthquake recovery authority (Adapted figure from Ombler 2015)

more and over 3800 aftershocks of magnitude 3 or greater between September 2010 and September 2012 slowed down reconstruction and added mental stress to residents. Stress-related depression and domestic violence reached the highest levels on record at that time (Hayward 2013).

Disaster recovery

The scope of destruction led the government to call for a "State of national emergency", prompting the intervention of the central government, the establishing of the Canterbury Earthquake Recover Agency (CERA), and the issuing of the Canterbury Earthquake Recovery Act 2011 (CER Act 2011). The CER Act provided, among others, for the Minister of the Canterbury Earthquake Recovery [the CER Minister] and CERA to direct recovery planning, to restore well-being of communities, and enable their participation without impeding a "focused, timely, and expedited recovery" (Toomey 2012). The CER Act 2011 was widely contested as it granted war-like powers with little constraint and oversight. Moreover, the CER Act 2011 severely weakened sustainability as it empowered the CER Minister to "suspend, cancel, amend or revoke wholes or parts of Resource Management Act [RMA] documents" (Toomey 2012, p. 14). The RMA (1991) is among "the first in the world to internalize the concept of sustainability as a defined and enforceable core obligation within a comprehensive integrated resource management structure" (Toomey 2012, p. 14). Thus, expedited disaster recovery came at the expense of CERA supplanting local planning and decision-making structures (Hayward and Cretney 2014) [4], and weakening sustainability. Using his powers, the CER Minister allowed changes of planning arrangements, some related to sustainability. In particular, central government overrode the award-winning public consultation process "Share an Idea" (c.f., Schwab 2014), which garnered 100,000 contributions to a sustainability vision for Christchurch and informed City Council's reconstruction draft (Hayward and Cretney 2014). The city's draft was replaced by the "blueprint", the plan to rebuild the city, produced primarily by experts reporting to the CER Minister, with little local consultation. Moreover, the CER Minister developed and implemented plans without accounting for the Urban Development Strategy [UDS], which the three neighboring district councils and other statutory partners had developed since 2007. This resulted in, e.g., accelerated greenfield development, road-building and widening, and residential intensification, mostly in areas with dense housing, while affluent neighborhoods were not densified (Salmon 2015).

With the end of CERA's term in April 2016, the special powers granted for the recovery period were partly redefined. The regeneration phase (see Fig. 2) will be led by two new recovery agencies (Regenerate Christchurch and Development Christchurch Ltd.). It will be the longest phase, requiring more stamina and vision from local leaders, at a time where many are disillusioned about prospects for change towards sustainability.

This central government-led approach to disaster recovery was further shaped by emerging post-disaster developments, which hindered progress towards sustainability.

First, the public discourse framed the approach to disaster recovery as an "insurance-led" and "free-market" approach (The Christchurch Press 2011a). Private and central government insurances paid about 73% of the repair and rebuilding activities. This was the greatest percentage of insured loss at the time and the fifth biggest liability event in the insurances' world history (Deloitte 2015:13, citing Munich Re, 2014). Delays in repairs and rebuilding, financial hardship, and mental health issues for many policy holders, and litigation aggravated the

[4] CERA hired more than 400 staff and 1000 consultants to work on the recovery strategy's 29 programs, entailing 116 projects.

situation (Toomey 2012). The insurance policy of rebuilding and repairing "like-for-like" to pre-disaster levels hindered sustainable reconstruction of buildings. Implementing energy efficient systems, insulation, or sustainable materials had to be paid through owners; they were not covered through the insurance policy (CC_10). "Like-for-like" was also the objective for restoring the "horizontal infrastructure" (drinking, waste, and storm water as well as road networks). Increased resiliency to seismic hazards could only be considered if "reasonable" and "economically feasible" (MacAskill 2014). The insurance-led process also contributed to pre-existing social divisions: as insurance claims were handled on an individual basis, communities, brought together through the shared earthquake experience, were again torn apart, further marginalizing vulnerable groups (CC_42, CC_59).

Second, the rebuild activities themselves created problems for sustainable development. In particular, the CERA's Blueprint (CERA 2012) pursued a top–down recovery plan centered around 18 large-scale projects or precincts (e.g., cultural, sports, and events facilities; urban housing demonstration projects; public services buildings; and green spaces). This left little room for public participation and organic growth of urban spaces (Bennett et al. 2014). The city found itself in financial dire straits with an exacerbated budget crisis as it had "overpromised and under-budgeted" related to the disaster recovery efforts (CC_33).

Third, Christchurch residents' psychosocial well-being changed overtime (c.f., Holyan et al. 2011). During early recovery, Christchurch experienced the high-peak of the post-impact "honeymoon", locally dubbed as the "front-end of the sustainability story", a time full of opportunities (CC_12). Since then, people worked through the hard years of disillusionment; the "back-end of the sustainability story;" expending energy and hopes to push sustainability and rectify the wrongs of the disaster recovery (CC_12). In 2015, many leaders of sustainability initiatives felt exhausted, disillusioned, and frustrated (Horn et al. 2015). The public discourse around sustainability often referred to two books: the *Shock-Doctrine* (Klein 2007) was referenced in relation with relocating people from the residential red zone, closing and merging local state-owned schools, and the power bestowed on CERA and its Minister. *A Paradise Built in Hell* (Solnit 2009) was used in reference to self-organized community processes (c.f., Vallance 2012; The Christchurch Press 2011a, b, 2012, 2015; Hayward 2013; O'Steen and Power 2016).

These pre-disaster, disaster, and post-disaster contexts influenced the opportunities presented by disaster and how people leveraged them.

Types of change opportunities triggered by the disaster

The disaster presented different types of opportunities for change, which some actors were able to leverage (see next section). A leader of one of CERA's recovery programs explained how she perceived different opportunities for change presented by the disaster:

> I talk about five different aspects […]: To not let things get worse. […] To repair and fix things up. […] The do-nothing opportunity. […] The take-advantage-of opportunity […] The fifth opportunity is around "increasing resilience." The latter two are very closely linked. Then there are opportunities that we have had and we would have liked to have taken, but did not. (CC_34)

Across all interviews, respondents included 'narrow' opportunities to contain or fix damage, as well as 'broader' opportunities to reform what is there and introduce innovations.

To contain

Disaster create damage, which, at a minimum, needs to be *contained*. For example, the earthquake-damaged houses exposed asbestos, presenting a public health risk. Damage was contained through cordoning off affected areas and demolishing buildings. A local scholar, researching sustainable disaster waste management strategies, obtained the mandate from the Ministry of Civil Defense and Emergency Management to develop an evidence-based training program for workers on how to safely handle asbestos during demolition (CC_39).

To fix

Disaster also present opportunities to *fix damage*, mostly to repair and rebuild to pre-disaster levels. In the asbestos example, the scholar, continuing work on the ground, developed guidelines for proper disposal of asbestos. Another example pertains to the social housing crisis. Despite long-standing calls, the government's recovery process did little to remediate the post-disaster housing crisis, especially for vulnerable groups. A coalition of Third Sector Organizations (TSO) went ahead and implemented a social housing program to create a precedent, and promptly, other TSO followed suit (CC_56). During my fieldwork, additional government-led social housing activities were announced. In the environmental domain, some destroyed wetlands and parks were designated as areas of self-remediation (CC_34).

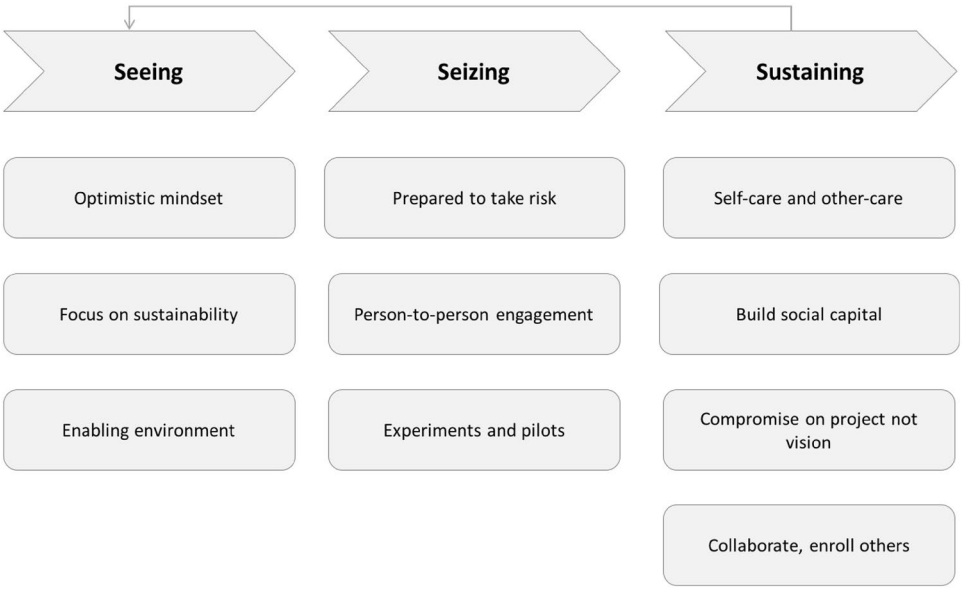

Fig. 3 To leverage opportunities agents employed various practices along a sequence of three phases. Others also identified a tripartite sequence (e.g., Westley et al. 2013)

To reform

Disasters also present opportunities to improve the situation through *reforms*. Staying with the asbestos example, reform could mean to amend building codes, preventing the use of materials that contain asbestos. Another example pertains to the local food justice movement originating pre-disaster. One respondent, involved with this movement, explained their efforts: "While we pursued the same activities and ideas [as ever] we just couched them in different languages to make our projects fit the earthquake situation. There was a void and we were ready to fill this void with good ideas" (CC_57). The earthquakes also presented opportunities to reform transportation in Christchurch. A respondent described the situation:

> Some small things were done, which would otherwise be difficult to be done in New Zealand because of the priorities of the Government and the funding policies. So, having the [new] infrastructure in the inner-city core is nice, but it does not address the issue of people living in 10 km distance and are unwilling to switch back after they used their cars again [post-disaster] and the new land-use structure has been established. (CC_13)

To innovate

Disasters also present opportunities to improve the situation through *innovation*. In the asbestos example, innovation could mean novel fire-repellent materials for repairing and rebuilding that are safe and sustainable. In Christchurch, the earthquakes presented an "indescribable" opportunity to introduce innovation leading to a "radical shift in the city's identity" as observed by a respondent who served on an advisory board for the design of the blueprint's projects:

> There has never been an opportunity for an Iwi [tribe] to influence the cityscape like this. So, the anchor projects […] will—as far as is possible within the existing constraints—reflect Ngāi Tahu [Māori tribe on the South Island] values, imagery, stories and names. This will be the first city in New Zealand that physically represents biculturalism. To the best of my knowledge, it would be the first city in the world that endeavors to physically represent heterogeneity in the urban landscape; and that is monumental. (CC_35)

Leveraging change opportunities

The interview data suggest that agents displayed different attributes and practices when seeing and seizing opportunities as well as sustaining introduced changes over time (cf. Figs. 1, 3).

Seeing opportunities for change towards sustainability

Some agents purposefully looked for opportunities. One respondent, a politician, stressed: "I see opportunities all the time, in good times and in post-disaster times" (CC_58). Others, who felt catapulted into the role of social entrepreneurs, saw opportunities, because they "always wanted to engage with sustainability" or were "deeply exasperated by the extent of the problem that was so bad in the first place" (CC_36a and CC_36b). They felt "primed in that sense

for an opportunity" and "the earthquake catalyzed" them (CC_36a and CC_36b).

In general, agents recognized opportunities after they had addressed all urgent needs. They paused in the midst of the post-disaster frenzies. One leader of the Canterbury mental health care department learned "to see where things do not add value and do not make sense in a way that was not or did not seem possible prior to the earthquake" (CC_21). Now, mental health care is restructured based on people-centered, community-based, and integrated care principles.

Most agents reported that they were able to see opportunities, because they "found themselves in a privileged position", including good health, some financial and professional wiggle room, and the endorsement from family and friends to venture off (CC_40). Another enabling condition was peer support. An agent, a consultant, stressed: "we were lucky because we found each other and we gave each other the peer support that we needed to first not do the self-doubt that 'I must be mad to think that this is possible'" (CC_35). Another agent, a politician, underscored that "not all opportunities were easy to see and people did not have experiences in doing it" (CC_58). The peer support created a "positive feedback loop" (CC_58) helping people "to think about the earthquake as an opportunity rather than a disaster" (CC_57).

Seizing opportunities for change towards sustainability

As one agent underscored, it is not enough to see opportunities, you need to motivate people to act, too (CC_36a). A key to seizing opportunities was for many actors to "just do it" to get ideas off the ground. One recommended: "Head forward instead of waiting […] Be wary, if something can be done now, do it! Otherwise, the opportunity is lost" (CC_41).

Taking this leap of faith and "stepping into the unknown takes courage and not all of us have courage" stated a leader of the Canterbury Health Board (CC_20). Another respondent, working for a charitable funding agency, summarized her experience of taking a risk:

> Knowing what I know now, I know I would never have started, because it was such a big thing that we were doing. But sometimes, it felt like the right thing to do; it felt like the right time. It seemed that Christchurch offered a place to trial and test some of these new things. (CC_52)

As stated, seizing opportunities required many agents to enroll a critical mass of stakeholders in their ideas. Sharing ideas with people meant to drag models around town and "took a lot of cupcakes" (CC_10) and "lots and lots of cups of coffee" (CC_36a). While neither "the advertising [nor] the media stories" worked, the "person-to-person discussion" was effective in getting people on board (CC_10). The key is to open ideas up for "rigorous examination" and not to proselytize: "we do not have time to convince people about our ideas. We have to hope they get it and run with us, otherwise we are getting bogged down" (CC_36b). While this "deep and authentic engagement […] is necessarily a slow process, […] the energy it builds up is very deep," (CC_36a) contributing to a sense of "collective accountability," which a few agents recognized as important driver (CC_20, CC_21, CC_24).

Person-to-person engagement also helped finding allies in government, who were open to realizing new ideas. One agent recommended "to have the right person from the right level in your group. Somebody who sits a little bit higher up that tree, who has access to information, but who also is a practical person" (CC_34). An agent involved with local sustainable food movement went deeper by stating that while networks are "useful structures, we have to be prepared to scrap them. The work is about nurturing joy and love. In the end that's what will keep people motivated to participate" (CC_57).

To seize opportunities, groups, such as TSO and start-ups in the creative economy, used experimentation: "I reckon it was 1–2 years where we had space to just experiment […] and lots of things have happened" (CC_35). Respondents found that experiments were encouraging, because often "the cost of failure is so little […] If it did not work out, you most likely did not harm anyone or anything and did not lose much" (CC_58). Meanwhile, agencies took research-supported approaches to gather evidence and build trust. One agent, trying to get developers and other stakeholders to invest in sustainable housing construction, explained:

> [The developers'] logic is: it is too expensive and it is too slow. They said: I don't believe it. And I said: Let's prove this. So, we applied those two guides [about sustainable housing] on 10 houses […] So, on the basis of these guides and on the basis of the ten case studies, we established the Canterbury Sustainable Homes Working Party. (CC_10)

Sustaining introduced changes towards sustainability over time

Agents had to sustain themselves as their context became increasingly challenging; as one agent explained: "things are starting to go back to normal […] the barriers to doing something—in fact anything—are coming back" (CC_40). Ensuring self-care meant "to manage yourself to manage the enterprise", because agents realized that they cannot run the endurance race of sustainability transitions at a sprinter's pace (CC_36a). In addition, agents had to cope with disempowering feelings of regret when looking at achievements: "the nagging question remains always

Table 1 Overview of select post-disaster sustainability initiatives across diverse daily activity fields (all appraised initiatives are documented in Online Appendix II)

Daily activity field	Interview respondent from	Select post-disaster sustainability change initiatives (interviewed)
Housing	City Govt	Build-Back-Smarter Program (commercial buildings and homes)
	Social Enterprise	Sustainable, open source housing design and construction
Worshipping	Third sector org	Collaboration of churches within and across denominations
Eating	Third sector org	Farmers markets and community gardens
	City govt	Food resilience network
Being mobile	Research	Christchurch Cycle pathways; regional light rail plan
Working	Third sector org	Social enterprise movement; hub for local entrepreneurship
	Central govt	Innovation precinct; health precinct (recovery projects)
Educating	Research	Student volunteer army; university community engagement
Recreating	Third sector org	Avon Otakaro River network; greening the red zone
Caring	District govt	Partnership for health in all policies
	Third sector org	Community well-being hub
Engaging	City council	Open Mic; Mayor in the chair; opening the books
	Third sector org	One-voice Te Reo Kotari; transitional city movement
Communicating	Social enterprise	Ministry of awesome
	Third sector org	Rebuilding the future of Christchurch; CanCERN; white elephant
Shopping	N/A	N/A

'could we have done more, better, and faster?'" (CC_13), especially "if we would have dreamed bigger and more daringly" (CC_35). To process such qualms constructively, some agents made a point of "taking time regularly to discussing things beyond the workday" (CC_36b), to be "kind" with each other (CC_20), and to engage in structured weekly reflections despite opportunity costs (CC_41).

Another practice was to keep the vision alive while working on a daily basis to deliver the project (CC_42). This contributed to the "healing process" and helped people "think forward not back" (CC_35, CC_40). In Christchurch, many "people fought against the imposed structures, which was a fight that they could not win at that time. They expanded a lot of energy, which they lost instead of investing it in something where it feeds them" (CC_47). Balancing visioning and working towards the vision enabled agents to see when new opportunities opened up and to be ready to seize them: "There is a time for everything. Sometimes, you just have to wait. But then—when the time comes—you have to go all in. But until then, you have to conserve your energy" (CC_33).

Another part to sustaining is ensuring relevance of one's sustainability initiative, while competition among organizations increased and disaster-related funding decreased. One agent explained:

> It was vital to acknowledge that other organizations exist and to engage with them. Of course, there is competition […] But if it is just [us], we as a city have lost; [our organization] has lost. These initiatives need to become part of a movement: the movement will outlive the individual initiative. (CC_40)

Moreover, agents reframed their activities. As many people had returned to a 'normal' life, agents made clear that they leveraged the disaster to advance the initiative, but the initiative was not contained by the disaster recovery; it exceeded it (CC_38).

To keep people enrolled, the Canterbury Health Board, for instance, developed the "permission card." Staff, completing a change management training, obtained the card. Playing the card meant that they could implement one change without asking permission *if* it helped the vision. The permission card reduced risks to "harden into the bureaucracies too soon" helping to keep "disruption and energy almost constant" (CC_20). Enrolling the broader public meant to inform about what is happening, especially when actual change was publicly invisible due to communication constraints. One agent underscored:

> If you see just a few things happening, as evidence, as physical evidence, of some progress; that is very optimistic and positive and inspiration. […] It has to be visible and make a difference. Otherwise, what you see there now is lots of wasteland and fighting. (CC_22)

Post-disaster change initiatives: programs, projects, and actions

There were many programs, projects, and actions ("sustainability initiatives") initiated across diverse daily activity fields and sectors (e.g., government, business, and society) in pursuit of the aforementioned opportunities (cf. Fig. 1). Table 1 presents an overview of select initiatives.

Stages of realization of sustainability outcomes

Leveraging opportunities translated into realizing sustainability outcomes. The data suggest four stages of realization. These stages demonstrably expand binary ideas of failure or success, often associated with windows of opportunities.

Manifest

Some post-disaster programs, projects, and actions leveraged opportunities successfully and resulted in real-world changes. One interviewee from the central government emphasized: "Many things were triggered and accelerated that were otherwise being put off" (CC_45). Manifest changes can be categorized in two types: material (e.g., services, technology, products, buildings, and roads) and ideational (e.g., laws, norms, and habits). An example for material change is the planned district-heating scheme (CC_20); an ideational change is the current city council's commitment to devolve decision-making power to community boards and citizen stakeholders (CC_33).

In process

Some post-disaster sustainability initiatives continue their efforts to create real-world change, despite initial failures in leveraging opportunities. For example, a number of TSOs were able to form a coalition and secure a seat at CERA's decision-making table. Although unable to effect tangible change, the coalition insisted to stay on. In the words of its delegate: "having a delegate there has shaped the way how these other organizations work […]. This is not outcomes; but it's process. And that's pretty cool!" (CC_7) Since then, the coalition has been invited to inform decision-making processes for the regeneration phase (CC_1).

Remain envisioned

Some post-disaster sustainability initiatives leveraged opportunities to build buy-in for their visions. A local city executive, supporting the visions around local living economies, stressed "people come to new ideas slowly. […] Often it is about talking about ideas and presenting them as ideas, just floating them, discussing them, dealing with the objections, but actually not pushing too far" (CC_34). The city's budget crisis opened the opportunity to revive ideas about local currencies to support public service provision and strengthened the visions around expanding the time-bank model spearheaded by a local TSO.

Discontinued

Some sustainability initiatives, despite having leveraged post-disaster opportunities, became "casualties of the recovery" (CC_35). Leaders of these initiatives either gave up, surrendering to the contextual challenges, or central government required initiatives to discontinue. For instance, the effort of neighboring homeowners attempting to merge their properties into collective ownership was discontinued as insurance companies were unable to provide collectively shared insurance at the time. The rebuilt missed the opportunity to restore ancient Māori burial places (CC_60). An advisor encouraged community groups to remain hopeful despite feeling "beaten up or let down", arguing that the very existence of their group "pulls the reality in a certain direction. So, even to be is to be successful" (CC_55).

Positive and negative effects on sustainability of leveraged opportunities and contextual factors

This section summarizes the results of the Sustainability "Plus" appraisal of post-disaster change initiatives, programs, projects, and actions as well as contextual factors (cf. Fig. 1). Figure 4 visually illustrates the results (more details can be found in the Online Appendix II).

Natural resources and environment dimension

Positive changes include, for instance, new rules requiring low-emission wood burners; self-remediation of select ecosystems; rebuilds using insulation; and sustainable materials and technologies (e.g., ground-sourced heat pumps) (CC_34). Co-governance among Māori tribal council, city councils, and CERA allowed that Māori values influenced land use and urban development plans (Kenney et al. 2015). While some plans, e.g., Natural Environment Recovery Program, are based on a strong notion of sustainability, other plans accounted for sustainability among other goals, for instance, the inner-city mobility plan (CC_13) or the guidelines for nice, accessible, and people-friendly streets and places (CC_26).

Negative changes, decreasing sustainability, include, for instance, the Land-Use Recovery Plan (LURP) that accelerates development of green fields, even in flood prone and peat land (Salmon 2015) and increases air pollution due to traffic congestion (CC_34). The city's new building code proposal was reversed by a Supreme Court ruling and central

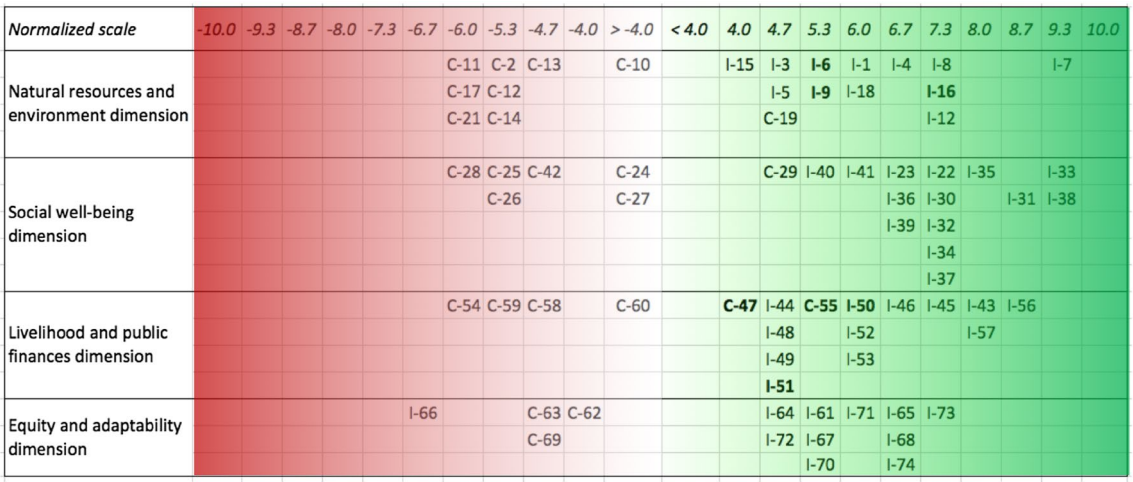

Fig. 4 Effects of the change initiatives are indicated in the cells. The 'I' is shorthand for Initiatives, programs, projects, and actions, the 'C' for Contextual factors. Bold font indicates future effects. Effects are plotted regarding: decreasing or increasing sustainability (sector red or green), specific sustainability dimension (row), and overall score, normalized on a ± 1–10 scale (column). Appraised initiatives, programs, projects, and actions are documented in Online Appendix II

government stopped the adoption of sustainable housing standards into the city plan (CC_10). Good waste management of construction debris was dropped for expediency (CC_39) and local materials and world-leading sustainable technologies were disregarded (CC_12, CC_28). Experts considered energy as the biggest opportunity but with least progress made, because the focus was on energy efficiencies and less on system-wide reductions (CC_10, CC_18). Actions reducing overall water use and increasing water quality are limited due to lax national legislation (CC_1).

Some environmental efforts have been undermined, but are expected to yield positive impacts in the future: district-heating program for energy saving (CC_20); expanding smart grid pilots (CC_18); scaling renewable energy projects (CC_10); adopting disaster waste management guidelines (CC_39); establishing conservation measures in the red zone (CC_42); increasing density in the city's suburbs (CC_29); and promoting commuter rail (CC_49).

Social well-being dimension

Positive changes, increasing sustainability, include: Māori culture will be inscribed in the design of all 18 anchor projects, representing biculturalism (CC_35). City council invests in the transition city movement in reviving vacant spaces and building communal gathering places (e.g., libraries) (CC_49, CC_50). Respondents praised this council as the "greenest" and "most generous and progressive council in terms of funding" (CC_46, CC_56, CC_57). Programs effectively supporting healing from disaster trauma were co-created by TSOs, health agencies, and CERA entities, leading to a CERA directive that future development demonstrably account for community resilience and well-being (CC_59). Overcoming their "naturally mercurial behavior", a coalition of TSOs emerged and informed CERAs recovery plans and now potentially implementation of the Urban Development Strategy (CC_7). Thus, in addition to vertical collaborations, various TSOs increased collaboration with each other (CC_54). The Canterbury Health District built capacity in their staff to address long-term effects of post-disaster stress (CC_20; CC_21). Progress has also been made in terms of civic engagement and self-efficacy: a groundswell of activities emerged that reclaimed participation in governance that was jeopardized during recovery (C_55). Moreover, voters elected a new city council in 2013 and the Māori community secured their role as statutory partner in disaster recovery (Kenney et al. 2015).

Negative changes, decreasing sustainability, parallel the above achievements. The rebuild, in particular of symbolic and civic spaces, is slow to be realized, and some are stalled by conflict (e.g., Christchurch Cathedral, Wright 2016). The provision of high-quality housing and land shows mixed results. The government-supported relocation of about 8000 properties from the residential red zone reflects a privilege in international comparison (Deloitte 2015). In contrast, respondents working for public health services, law firms, and human rights groups highlighted the hardships it caused (CC_9, CC_21). Despite a widening socio-economic divide, some governmental social services emerged slowly, such as social housing for marginalized and disadvantaged groups (CC_56, CC_21). While the insurance policy of rebuilding like-for-like precluded sustainability measures ("betterment") (CC_10, CC_24), rebuilding with modern materials and better insulation elevated housing quality, which

was below OECD average pre-disaster and a public health hazard (CC_29, CC_45). The provision of public facilities and services shows mixed results, too. While the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) adhered to rebuilding horizontal infrastructure like-for-like, it found ways to account for betterment: using resilient materials and more manholes for serviceability, increasing lifespan and reducing the amount of excavated soil being landfilled (CC_24).

Future potential to enhance the social dimensions of sustainability exists. City council staff reported how the city advanced programs to support sustainable housing and ensure quality of rentals despite pushback from central government (CC_10). Other progressive sustainability housing initiatives emerged in the public and private sector (CC_36). TSOs are increasingly included in decision-making processes on the local level from the planning stages in deliberative, not only consultative roles (CC_38). This breakthrough is expected to continue (CC_33). Public services around transportation can draw on the new bus interchange and council's investment in cycle ways as measures to improve accessibility (CC_13).

Livelihood and public finances dimension

Positive changes, increasing sustainability, pertain in particular to the take-off of the social enterprise movement and the creative economy resulting in institutional structures in central government and among charitable funding organizations to support such livelihoods (CC_52). One of the biggest employers in the region (CDHB) transformed its conventional Occupational Health and Safety into a holistic well-being approach for its staff (CC_20). The local economy is somewhat strengthened. For instance, the new Health Precinct will offer high skill and high value jobs, fostering innovation networks in the local economy (CC_20). The award-winning alliancing model of SCIRT spread wealth among local and other contractors in contrast to monopolistic models used in the vertical rebuild (CC_55). Time banks are operated through grassroots organizations (CC_1). The Māori tribal council's role as an increasing economic player in the South Island is expected to strengthen the local economy in areas of housing, dairy and water (CC_49). Although public finances were in disarray before the disaster and further strained by the disaster recovery, city council aims to provide for the public good in the public's interests (CC_33) by: opening the books, consulting on its long-term plan, entering public–private partnerships to effectively deliver services such as social housing (CC_56) and waste management (CC_39). Some disaster recovery funds were directed towards sustainable housing enterprises (CC_52) and collaboration across social service providers to empower local communities (CC_54).

Negative changes, decreasing sustainability, entail an aggravated brain drain of youth (CC_11) and people expect much lower job growth than projected from the blueprint's anchor projects (CC_58). Aside from employment for civil servants, many anchor projects (e.g., stadium, convention, and metro sports center) are expected to offer mostly low-skill and low-paying jobs (CC_1). The local economy in the downtown area was weakened because of the yearlong cordon (Wright 2016); now, the inner city is not affordable for many local enterprises, preventing their return (CC_40).

Future potential to increase the economic dimensions of sustainability exists. For one, Christchurch city council staff envisions a local green economy driven by existing energy producers (e.g., biomass, landfill gas, and solar). Developing an alternative currency and time-banking model can alleviate municipal budget constraints and cash-strapped residents (CC_33). Better integration of city and regional processes is explored to strengthen the local economy (CC_38).

Equity and adaptability dimension

The disaster recovery is considered to have aggravated injustices and responses have been initialized. For instance, the human rights commission evaluated recovery activities and recommended rectifying actions; the health sector invested in capacity building to treat chronic post-disaster issues; the city diversified its public participation approaches. District governments collaborated on the Urban Development Strategy to cope with injustices, with advice from TSOs (CC_1, CC_54). Emerging injustices include the inequitable distribution of recovery costs. The East side of greater Christchurch, home to lower-income communities, suffered severe impacts and received less attention; it will bear the brunt of the recovery.[5] The insurance payouts created impacts for individuals and families, ranging from benefits to negative effects. Other changes, such as failure to rebuilt transport and housing systems in climate-friendly ways, will negatively impact future generations. Replacing the open-ended insurance policy with a dollar limit will create new vulnerabilities (CC_16).

In terms of adaptability, few plans take on a long-term perspective, accounting for different scenarios. Guidelines for sustainability goals have been proposed by a few groups, including city council (CC_10), the Health Board (CC_20), and some social enterprises (CC_36), trying to use the recovery process to advance these goals. In contrast,

[5] At the time of writing (2016) the East side (New Brighton) will receive support for the regeneration phase. Some community leaders, see this as a unique opportunity. The challenge lays in harnessing the opportunity with good governance in mind. (The Christchurch Press, 2016, Sept 5.)

the central government cut sustainability out of key documents and stymied sustainability initiatives (CC_8, CC_10, CC_50).

Progress is underway related to integrating disaster risk reduction and sustainability. Lessons from the Māori disaster response will inform future disaster management organized around sustainability values. Resilience goals of Christchurch include risk-based land-use planning and economic analysis of risk management options (CC_50).[6] The building code was strengthened to reduce seismic and flood risk and the rebuilt infrastructure used a safe-system approach and seismically resilient materials (CC_10, CC_24). Social capital has been fostered through activities by grassroots, social service providers, and local enterprises, contributing to resilience (Horn et al. 2015). Sustainability shortcomings include, among others, rebuilt infrastructures and buildings favoring engineered over natural systems (CC_34) and conventional over innovative, local, construction technologies with better seismic performance and public health benefits (CC_12, CC_28).

Discussion

To offer advice on how to leverage disasters for sustainability, this section discusses the findings of the six research questions (cf. Fig. 1):

Context factors

1. *Which context factors influenced leveraging post-disaster opportunities for change actions (towards sustainability)?* Key leveraging factors are those that were salient across all three contexts; in particular the availability of sustainability knowledge and action on institutional (e.g., policy, human resources) and individual (e.g., expertise, networks) levels. Governance arrangements were also key to advance sustainability. Cross-scale networks of agents, e.g., those involved with advancing social enterprises and public health initiatives, transcending the top–down/bottom–up dichotomy effectively supported institutionalization of efforts, whereas the special powers given to the CER Minister hindered them. This finding supports indications from both, sustainability transitions and disaster recovery processes drawing attention to the role of networked governance as well as linking capital to achieve sustainability outcomes (c.f., Guarnacci 2012).

Types of change opportunities

2. *What opportunities did the disaster offer?* It is now recognized that disasters present opportunities for change (e.g., Birkmann et al. 2009; Pelling and Dill 2010; Wiek et al. 2015). These are often presented as "once-upon a lifetime" type of opportunities (Bennett et al. 2014). Meanwhile, this research expands this narrow notion, revealing that actors perceived a range of opportunities presented by disasters, including small, incremental opportunities and broader, potentially transformative opportunities to foster sustainability. Moreover, some agents continued looking for opportunities to leverage change towards sustainability despite contextual challenges and setbacks throughout the recovery. The typology illustrates the many ways disasters can catalyze change after the disaster event and over time. Furthermore, the typology helps integrate incremental, but achievable, changes, with aspired transformational changes. Instead of discounting incremental changes, they can be used to help prepare the ground for transformational changes; as one respondent said, small changes can provide "evidence of some progress" (CC_22). When used strategically, the typology helps connect efforts to build back better (improving disaster recovery, mitigating hazard risk) with broader goals of sustainability, i.e., addressing disaster-unrelated problems in social-ecological systems. Similarly, it can balance needs for immediate actions to rebuild and long-term planning for sustainability (c.f., Kates et al. 2006).

Phases of leveraging change opportunities

3. *What were the main mechanisms of leveraging the opportunities, i.e., practices and attributes of the change agents?* The study underscores that disasters present opportunities, and identifies human agency as main mechanism to leverage them. Leveraging requires the ability to see and seize opportunities and to sustain introduced changes over time. This finding complements initial evidence of actors' abilities when aiming to build social-ecological resilience in normal times (c.f., Westley et al. 2013). Additionally, the study indicates that actors who had sustainability experience prior to the disasters were able to act fast during disaster recovery, e.g., reducing future disaster risk to flooding or using time-banking to increase social resilience. Newcomers to sustainability, in contrast, experienced a steeper learning curve. Under adverse and fast-paced post-disaster

[6] Christchurch was elected to partake in the 100 Resilient Cities Initiative sponsored by the Rockefeller Foundation.

circumstances, these newcomers were "learning while transforming."[7] This suggests that the ability to leverage opportunities for sustainability can be trained. Such training benefits both: normal and disaster times. It contributes to sustainable development projects in normal times while building disaster preparedness of a different kind: preparedness to see and seize opportunities for sustainability in the midst of devastation and loss. Select recommendations for building novel disaster preparedness for sustainability include:

Seeing opportunities Agents emphasized that seeing opportunities entails the ability to construct visions so that others can see opportunities, too, and find purpose for action, in the immediate aftermath of the event and over the long haul of disaster recovery. In the absence of such visions, an agent cautioned: "people will look back, [as] they don't know where they are going. And that is the biggest risk that we face, that there is no vision for the city" (CC_20). Agents found their ability to envision and imagine different futures is supported through a positive mindset (c.f. Sect. 3.3). This finding suggests that training people both in sustainability and positive mindsets will be useful. The success of the Canterbury District Health Board supports this recommendation, as their sustainability change initiatives combined training in sustainability with positive psychology. My study adds to the insight that disaster and sustainability research alike need to draw more on positive psychology to support agents' abilities to see opportunities both in normal and disaster times (Masten and Obradovic 2008; Moser and Berzonsky, in review; Harré 2011).

Seizing opportunities meant moving ideas into action, which was often enabled through connecting sustainability initiatives with each other, to facilitate collective impact, and with funders/investors to finance them. Facilitating such connections involved brokers or liaisons, with the city's regular sustainability officer, a highly skilled broker, being the key point of contact. However, in a disaster recovery process of the scope experienced in Christchurch, one sustainability liaison is quickly overcommitted. Agents regretted government's failure to fund more such positions, because various sustainability initiatives could not be connected to resources and interested funders/investors left Christchurch, feeling unable to help (CC_18). The role of the liaison is well recognized for sustainability problem solving in normal times (Williams 2002; Brundiers et al. 2013; Fischer and Newig 2016). This study suggests that there is an equally important role for such liaisons in disaster times to advance sustainability; failure to support such positions results in costs and missed opportunities.

Sustaining introduced changes required renewing and reinforcing collaboration, which was challenging. After the initial spike, the level of collaboration receded over time, meanwhile, the funnel to introduce changes seemed to become narrower, as some ideas became embedded in plans, and in concrete and steel, and other ideas have not (CC_55). In the words of this agent, sustaining introduced changes and making "long-term wins" required to "win the endurance race" and to "hold out while everyone else gets weeded away", all depending on collaboration. Initiatives that evolved from seeing to seizing to sustaining were those that built human and social capital by engaging in self-care and other care as well as fostering horizontal collaboration (building bridges to similar organizations) and vertical collaboration (building linkages with government and market players). This study corroborates similar findings from disaster recovery (c.f., Vallance 2011; Consoer and Milman 2016) adding that agents' ability to combine such bridging and linking capital and their ability to ensure self- and other care seems to be pivotal for translating sustainability changes into formal institutions, too.

Post-disaster change initiatives

4. *What specific post-disaster change initiatives were undertaken?* Programs, projects, and actions were the vehicles to realize opportunities. My research indicates that initiatives, seeking change towards sustainability, emerged as both, self-organized informal bottom–up and formal top–down, initiatives in *diverse* daily activity fields, and initiating actors came from civil society, business, and government sectors. Moreover, many initiatives are a response to the pre-disaster situation, addressing root causes, dynamic pressures, and unsafe conditions. Chief among them were responses to root causes, including responses to the neoliberal governance model that eroded local democratic practice; to central governments' efforts to replace sustainability with resilience; and to the housing crisis, a dynamic pressure. Agents stressed that their initiatives accelerated or emerged during the disaster recovery and contributed to it, but were not limited to the disaster recovery process (c.f., CC_38). This highlights that initiatives focused on advancing alternative development, while reducing various aspects of vulnerability (not limited to hazards). Comparing the sustainability initiatives with the Sustainable Development Goals (SDG), in hindsight, suggests that each sustainability initiatives included in this research can be related to at least one of the SDG. Going

[7] Wiek & Kay, 2015.

forward, such relations could be explicitly encouraged and pro-actively strengthened, in particular when post-disaster funding and policy would require initiatives to demonstrably address one or more SDGs. Unfortunately, this was not the case in Christchurch, except for few organizations that allocated funds to sustainability-oriented projects (CC_10; CC_52).

Stages of realization

5. *What was the stage of outcome realization of the leveraged opportunities (towards sustainability)?* The study produced an empirically informed typology of outcome realization (manifest, in process, envisioned, discontinued), which proposes an alternative to the success/failure dichotomy. Thus, the typology can serve as a tool to support sustainability initiatives during the disaster recovery process and over the long run. One respondent stressed the need to look forward and plan future actions despite past setbacks and failures: "there are still many things that need to be addressed as part of the recovery, others need retrofitting, and on a societal level the changes and unintended consequences that have happened have not even unfolded and manifested. As the recovery is and should go on, there will be more opportunities coming, but one needs to be able to see them" (CC_54).

   In this process, a strategic question for many agents and at each stage of realization was whether or not to make change visible or keeping it obscure and for whom. Lack of visibility can hinder people to support initiatives. For instance, at the time of my research, a frustration was growing, because few things seemed to be happening on the ground, while it became clear to people that disaster recovery was going to take many more years. Meanwhile, some "indescribable" changes are actually in production, resulting, e.g., in the "first city in New Zealand that physically represents biculturalism;" yet, only those with insider knowledge knew about them (CC_35). In other instances, lack of visibility was purposefully sought to ensure successful realization of the initiative, such as in the case of TSOs providing social housing avoiding to enter the contested public debate.

   The concept of staged realization also offers academic benefits. It adds evidence to Pelling and Dill's (2010) argument about anchoring change through alternative discourses, technologies, and power structures, and it links sustainability-oriented disaster recovery efforts to multi-level transition management, expanding the few studies to date in this field (cf. Becker and Reusser 2016). The sustainability initiatives in Christchurch, although originating in disaster context, reflect what the theory of sustainability transitions describes as "initiative-based learning transitions", where actors use experiments to facilitate learning by doing, to shape pathways and respond to emergent processes (Turnheim et al. 2015). This suggests that agents in Christchurch could employ transition theory to inform their actions going forward.

Sustainability effects

6. *To what extent did they positively or negatively impact sustainability*? Leveraging post-disaster opportunities for change towards sustainability resulted in positive and negative effects, enhancing and decreasing sustainability. Overall, the sustainability change initiatives did little to bring about the necessary far-reaching sustainability change. Nevertheless, they planted seeds of change, and are local reflections of larger, but slow moving, sustainability change processes. However, they are not always recognized as a leverage point, especially when applying contemporary assessments. Three examples illustrate this point.

   In the dimension of livelihood and public finances, a contemporary assessment looks for evidence of economic viability, often defined as economic activity having returned to pre-disaster levels. Viewed through this lens, the Canterbury economy has been largely resilient (Wood et al. 2016). Nevertheless, evaluating long-term economic growth against pre-event levels is problematic (c.f., Noy and DuPont IV 2016). From a sustainability perspective, the question is whether there is evidence of economic activity taking on a different direction (e.g., green and steady-state) and quality (e.g., equitable and meaningful livelihoods). The appraisal highlights the tension between contemporary and sustainability criteria. For instance, the efforts aimed at building a local living economy (including time banks, local currencies, and creative economy) were belittled by some respondents as "nice to have"; they were not recognized as drivers of the economy (CC-62). Meanwhile, evidence from Aotearoa New Zealand, commissioned post-quake, and internationally, documents their contribution to more diverse, inclusive, and resilient economies (e.g., Horn et al. 2015; Lyth et al. 2017).

   The dimension of social well-being illustrates friction between sustainability seeds and inertia of contemporary assessments, i.e., in perceptions about power. In hindsight, some sustainability change agents reckoned that they spent too much effort fighting the top–down power structure, which allowed the CER Minister to exercise power over the disaster recovery process, stymieing sustainability efforts. Working against this, they experienced setbacks causing suffering and discouraging fur-

ther action. Utilizing alternative forms of power *earlier* might have yielded other outcomes. These alternatives often lead to people appreciating effects of power when resulting from cooperating and learning (power with) and from building alliances that empower each other and support resistance (power to) (cf. Avelino and Rotmans 2009; Partzsch 2015). In another case (Myanmar), Becker and Reusser (2016) found that the government was forced to give up some control over the disaster recovery process and engage in cooperation, because local actors (niche level) and the international community (regime actors) successfully collaborated.

In the dimension of natural resources and environment, a tension between sustainability seeds and contemporary approaches relates to build back better. For instance, repairing "like-for-like" to pre-disaster levels led to improvements by virtue of using modern technologies enhancing energy efficiency, air quality, and public health. It did not lead to sustainability increases (i.e., reductions in energy consumption). Moreover, while improvements to the building code to ensure seismic safety passed, many improvements related to sustainability were prevented by central government.

Considering some of the ongoing efforts to advance sustainability, the visual display of select sustainability initiatives and contextual factors (cf., Fig. 4) makes visible intervention points. The left side represents intervention points that require strong effort to remedy missed sustainability opportunities or regress. The green side represents intervention points that allow focusing resources on strengthening what is already in process.

There are *shortcomings* of this study, in particular related to the Sustainability "Plus" appraisal, which lacks an expert-based inter-rater reliability testing (making sure the appraisal results are reliable). The study was self-financed, which constraint the reliability testing, which would have required hiring a second evaluator (working through 80 + transcripts and additional documents used for the appraisal). Nevertheless, the study presents a solid start, as all information was bundled and "thickened" consistently by the same person. The process empirically tested the proposed framework and its preliminary results have been presented and "validated" in two meetings with research participants in Christchurch (Brundiers 2016).

Conclusions

This study revealed how disasters catalyze change in many ways. It explored people's and organizations' pursuit of change towards sustainability, leveraging opportunities presented by a disaster. In the Christchurch case, changes across daily activity fields, such as housing, caring, recreating, being mobile, have been pursued with different degrees of success, using opportunities for incremental and transformative changes. One of the limiting factors was the power bestowed on individuals, the most prominent example being the Canterbury Earthquake Recovery Minister. While this situation narrowed the operating space for the sustainability change agents, they continued to push for change towards sustainability. This speaks to the agents' ability to adapt *under* adverse circumstances and not to them. These agents have continued their efforts long after the big, post-disaster window of opportunity closed. In addition, it sheds light on the role of individual, yet networked, agency of all kinds in influencing governance and sustainability change processes. As the attrition of democracy during disaster recovery is well known, this study reaffirms the need to prepare for disaster recovery before the disaster hits, in particular through sustainability visioning in normal times as well as supporting sustainability leadership and governance arrangements.

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