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To cite this article: Gina Ziervogel , Johan Enqvist , Luke Metelerkamp & John van Breda (2021): Supporting transformative climate adaptation: community-level capacity building and knowledge co-creation in South Africa, *Climate Policy*, DOI: [10.1080/14693062.2020.1863180](https://doi.org/10.1080/14693062.2020.1863180)

To link to this article: <https://doi.org/10.1080/14693062.2020.1863180>



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Published online: 22 Jan 2021.



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Supporting transformative climate adaptation: community-level capacity building and knowledge co-creation in South Africa

Gina Ziervogel ^{a,b}, Johan Enqvist ^{a,c}, Luke Metelerkamp ^d and John van Breda^e

^aAfrican Climate & Development Initiative, University of Cape Town, Rondebosch, South Africa; ^bDepartment of Environmental and Geographical Science, University of Cape Town, Cape Town, South Africa; ^cStockholm Resilience Centre, Stockholm University, Stockholm, Sweden; ^dEnvironmental Learning Research Centre, Rhodes University, Grahamstown, South Africa; ^eCentre for Complex Systems in Transition, Stellenbosch University, Stellenbosch, South Africa

ABSTRACT

Calls for transformative adaptation to climate change require attention to the type of capacity building that can support it. Community-level capacity building can help to ensure ownership and legitimacy of longer-term interventions. Given that marginalized communities are highly vulnerable to climate risk, it is important to build their capacity to adapt locally and to integrate their perspectives into higher-level adaptation measures. Current adaptation policy does not pay sufficient attention to this. Using a Cape Town-based project on water governance in low-income urban settlements, this paper explores how a transdisciplinary research project supported capacity building. Our findings suggest that knowledge co-creation at the community level is central to the capacity building that is needed in order to inform transformative adaptation. The collaborative methodology used is also important; we illustrate how a transdisciplinary approach can contribute to transformative adaptation where knowledge is co-produced to empower community-level actors and organizations to assert their perspectives with greater confidence and legitimacy. We argue that if capacity building processes shift from the top-down transfer of existing knowledge to the co-creation of contextual understandings, they have the potential to deliver more transformative adaptation. By considering diverse sources of knowledge and knowledge systems, capacity building can start to confront inequalities and shift dominant power dynamics. Adaptation policy could provide more guidance and support for community-level transdisciplinary processes that can enable this type of transformative adaptation.

Key policy insights

- To address equity and justice issues as well as climate risk, adaptation policy needs to better support transformative adaptation.
- Community-level capacity building, called for by developing countries, will benefit from more attention to bottom-up approaches as a complement to top-down ones.
- Community-led research that draws on a diversity of knowledge systems can effectively inform the development of transformative adaptation interventions.
- Transdisciplinary research methods present a promising pedagogical approach to building transformative adaptation capacity.
- Adaptation policy for capacity building would benefit from a broader understanding of governance that includes local participation and values bottom-up contributions.
- A priority for capacity building is getting previously excluded actors a spot at the negotiating table as well as skills to substantiate their arguments.

ARTICLE HISTORY

Received 20 June 2020
Accepted 8 December 2020

KEYWORDS

Capacity building;
transformative adaptation;
transdisciplinary methods;
adaptation policy; learning;
community-level adaptation

CONTACT Gina Ziervogel  gina@csag.uct.ac.za

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1. Introduction

Calls for transformative adaptation to climate change impacts are growing, given the imperative to shift towards more equitable and climate resilient development pathways (Lonsdale et al., 2015; Pelling, 2010; Revi et al., 2014). Transformative adaptation promises ‘transformation of broader aspects of development through adaptation activity’ (Few et al., 2017, p. 6). This means that there exists, alongside the goal of reducing climate risk, a goal of simultaneously addressing issues of social justice and the root causes of risk (Pelling et al., 2015; Ramos-Mejía, Franco-Garcia, & Jauregui-Becker, 2017). Capacity building efforts under the United Nations Framework Convention on Climate Change (UNFCCC), however, often focus on incremental adaptation, with limited attention to power and justice (Archer & Dodman, 2015). We argue that the growing focus on transformative adaptation requires attention to new types of capacity building that rely on knowledge creation at a grass-roots level as the first phase of building capacity, and on the empowerment of community actors to meaningfully inform and implement adaptation responses as the second phase. We look at this with a focus on water governance in Cape Town, South Africa. Critically, policymakers need to consider both how such bottom-up responses can be supported, and how they can help inform broader climate adaptation.

Although the UNFCCC has increasingly focused on capacity building since 1992, there is limited agreement on how to strengthen the design and implementation of adaptation efforts on the ground (Alpizar et al., 2019; Khan et al., 2018; Mataya et al., 2019). Capacity building is the most frequently requested type of support among countries that make their Nationally Determined Contributions (NDCs) conditional upon at least one type of support (Pauw et al., 2019). It is mainly developing countries that request capacity building support in their contributions and their requests are often vague (Khan et al., 2020). This is partly due to the breadth of interpretation of capacity building, generating what some describe as a ‘risky, messy, murky business’ (Morgan, 1998 in Khan et al., 2018, p. 5).

A need that is stressed particularly by developing countries is for community-level capacity building for adaptation (UNFCCC, 2020). Community-level capacity building entails ‘work with local deprived communities to promote fuller engagement with social, economic and political life’ (Craig, 2007, p. 10). Given the local nature of much adaptation, building community-level capacity is much needed (McNamara & Buggy, 2017).

Approaches to build capacity for climate adaptation range from educational activities to workshops to methods such as ‘learning labs’ centred on complexity and the co-production of knowledge (Archer & Dodman, 2015; Ison et al., 2015; Scott et al., 2018). Most capacity building support efforts through the UNFCCC process have unfortunately been ad hoc and short term, rather than targeting institutional change (Khan et al., 2020). Climate adaptation workshops have been commonly used to educate individuals, but these events are unlikely to mobilize capacity at the scale of the adaptation challenge. Rather, effective social mobilization, combined with the right mix of policies and research, applied over time can help to fast-track progress towards more just and resilient pathways (Biehl, 2015; Lubell & Niles, 2019). Some problems can be addressed by drawing on pre-existing institutions, but addressing more systematic issues such as social injustice might require transgressive approaches (Bengtsson, 2019; Pelling et al., 2015). Bengtsson (2019, p. 1) defines transgressive approaches to learning as ‘contextually diverse techniques and practices that attempt to bring about change through and in learning’ through the ‘subversion of rules, contexts, and borders’. Rather than focusing on education as a means to support continuity, transgressive pedagogies focus on disruptive capacity building that breaks away from the ‘maladaptive resilience of unsustainable systems’ (Lotz-Sisitka et al., 2015, p. 73).

If approaches to building climate resilience capacity can start to explicitly confront issues of power and justice, they are more likely to be able to contribute to transformative change (Archer & Dodman, 2015). In the water context, groups with less power are marginalized not only when denied resource access, but also when their worldviews and ideas are dismissed in policymaking (Balazs & Lubell, 2014). In the South African context, social justice and redress are sought particularly for people of colour who are living in historically neglected parts of the city with poor services. If people who experience water issues daily are given an opportunity to tell their stories and thereby contribute to water governance, it may help start the redistribution of hidden power (Gaventa, 2006).

Transformative adaptation and transgressive learning question the dominance of the educationally privileged as this group is often the least affected by climate impacts (Grabowski et al., 2019; Mauser et al., 2013). However, these changes necessitate a radically broadened source of knowledge, especially in the growing urban areas of developing economies where high levels of informality and low enrolment in tertiary education are the norm (Blythe et al., 2018). Recognizing the ‘inherent validity of individual and collective experiences in framing knowledge needs’ can support capacity building efforts in ways that also address the social alienation of the residents whose wellbeing is the subject of adaptation interventions (Grabowski et al., 2019, p. 70).

One way of supporting more democratic and inclusive knowledge creation is to approach capacity building through a transdisciplinary lens (Cornell et al., 2013). Transdisciplinary methods need to first draw in the societal actors who are *affecting* and *being affected* by the problem; then, the concerned societal actors and scientific actors can work jointly to turn the problem into scientifically valid questions (Jahn, 2008). Methods for developing new insights and approaches become as relevant as methods for sharing existing ones, if not more so (Metelerkamp, 2019). Collaborative transdisciplinary research efforts between researchers and non-academic partners have the potential to strengthen legitimacy, accountability and ownership of both the problem and the possible solutions that the process identifies (Mauser et al., 2013). Enabling the voice of the marginalized to be better heard and trusted can support climate justice goals that recognize everyday risk (Ziervogel et al., 2017). Through stories, hidden power can start to shift, uncovering more diverse voices (Veneklasen & Miller, 2003). Institutionalizing and scaling up these types of transdisciplinary adaptation interventions can be hard, as tensions often surface between ‘experts’ and residents (Kim & Kang, 2020). Part of the challenge, then, is to determine when different types of knowledge are needed, and the degree to which they should be integrated into approaches. This type of work contributes to showing how transdisciplinary knowledge co-production can inform sustainability transitions, where currently examples are limited (Schneider et al., 2019).

‘[A]daptation is fundamentally dependent on new forms of learning’ (Collins & Ison, 2009, p. 358) – particularly in contexts of radical uncertainty, which is often characteristic of current environmental crises. One form of new learning involves shifting the emphasis from the top-down transfer of existing knowledge to social learning and the co-creation of contextual understandings of how to bring about change (Balazs & Lubell, 2014). Where learning is grounded in context and draws from a broader set of knowledge systems, it can inform measures towards transformative adaptation and empowered communities (Figure 1). This can be formal, explicit learning; however, it often takes place informally through ‘murmurs that discuss alternatives in the streets, squares, homes and workplaces’ and through ‘the creation of spaces for meeting and finally for organizing’ (Zechner & Hansen, 2015, p. 138).

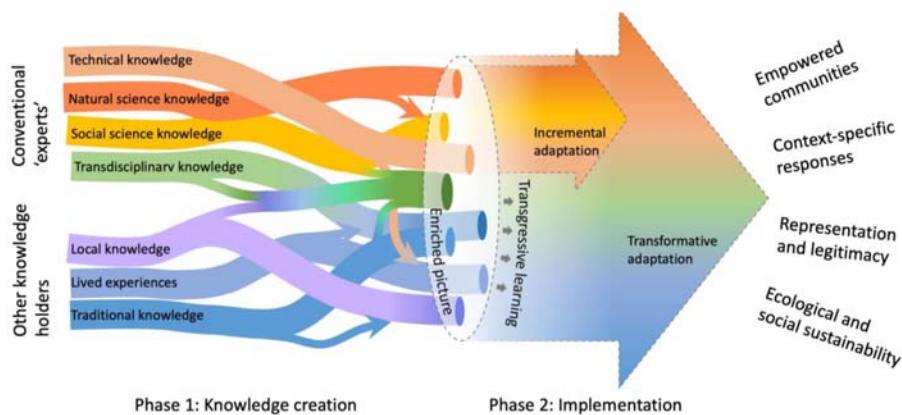


Figure 1. Capacity building for transformative adaptation. A broader set of knowledge types can help enrich the understanding of a selected issue, creating greater legitimacy and a better basis for decision-making. This can underpin capacity building towards transformative adaptation that empowers communities while also achieving sustainability goals, all through context-specific responses that represent local interests. Adapted from Tengö et al. (2014).

Empowerment, i.e. ‘the process through which actors gain the [capacity] to mobilize resources and institutions to achieve a goal’ (Avelino, 2017, p. 517), is especially important in preparing for the second phase of capacity building: implementation (see Figure 1). Empowerment is ‘the crucial ingredient for grasping windows of opportunity and actively shaping change in this transition’ to transformative adaptation, especially in the context of severe poverty and vulnerability (Tschakert & Dietrich, 2010, p. 5). The power to effect change relies on relational capacity that is underpinned by relationships between a number of actors, resources and skill sets that can be drawn on when needed (Westley et al., 2013). However, because it is often impossible to predict when windows of opportunity will emerge, social structures with networks of affiliation and trust ‘must be consciously created well in advance of the revolutionary moment, through painstaking, molecular work’ (Biehl, 2015, p. 75).

This paper aims to explore how a transdisciplinary research approach might help to build community-level capacity for transformative adaptation. It draws on a project that sought to understand water service issues and strengthen community-based adaptation in low-income areas of Cape Town, South Africa; this project has been described in Enqvist et al. (2020). The city’s recent experience of a crippling drought brought home the importance of adapting to urban climate risk (Simpson, 2019), but also served as a reminder that low-income households have lacked adequate water services for decades (Enqvist & Ziervogel, 2019; Millington & Scheba, 2020; Rodina & Harris, 2016). Urban water vulnerability is complex and depends as much on land-use management and planning as it does on climate change (Ahmed et al., 2018). In the South African context, this vulnerability is intricately intertwined with a history of apartheid and land dispossession. For cities globally, it is important that adaptation to climate risk and water stress simultaneously addresses past injustices (Finewood & Hollifield, 2015).

Our paper proceeds as follows. First we set out our methods that provide context on the case study and the use of a transgressive pedagogical lens to reflect on the SenseMaker project. We then present the results exploring the process of knowledge co-creation as part of the community-level capacity building process. Building on this, the discussion reflects on the type of policy shifts needed to build community-level capacity particularly for collaborative knowledge creation. We suggest that capacity building that empowers individuals and organizations to better adapt to climate risk and water stress, can also support much needed transformative adaptation.

2. Methods

The findings in this paper are based upon a reflection on, and analysis of, the research process behind the SenseMaker research project (i.e. Enqvist et al., 2020). This research project was designed and implemented by the four authors of this paper, all academics, in collaboration with a community-based organisation (CBO). The project formed part of a broader action learning process (see Figure 2), which aimed to understand water issues in low-income neighbourhoods and develop actions to address them. The term ‘SenseMaker’ refers to a tool designed to collect short narratives and quantitative data, where respondent interpret their own stories, also known as self-signification (Lynam & Fletcher, 2015; Metelerkamp et al., 2019). As such, the tool served the project’s aims of co-producing knowledge across multiple communities for transformative purposes (see Enqvist et al., 2020 for details). The idea was that this research could then feed back into the larger action learning process to support implementation and advocacy.

The data we present here is qualitative and interpretive. It is based on an ethnographic perspective from which we, as participating academics, reflect on the SenseMaker project – in particular, on how its use of a narrative-based approach enabled the facilitation of knowledge creation and other emergent outcomes. The data were generated from an iterative practice of individual and collective observation and reflection, both during and after the 10-month project. In the remainder of this section, we briefly introduce the case study and the project (2.1), describe the learning process that ran alongside it, and explain our method of analysis (2.2).

2.1. Study background

Cape Town’s municipal water comes from six dams in the surrounding mountains. However, service access is unequal, as municipal service providers still struggle to erase the legacy of colonial and *apartheid* discrimination

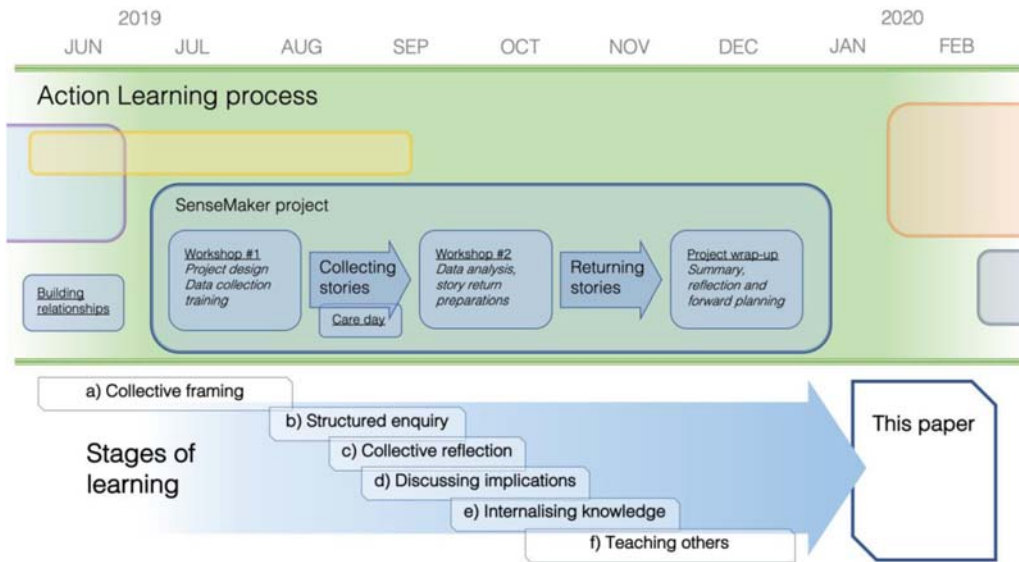


Figure 2. Top half: Timeline for and main components of the SenseMaker project, conducted as part of the broader action learning process. Bottom half: The different stages of learning (a–f) that took place during each phase of the SenseMaker project.

(Beck et al., 2016; Enqvist & Ziervogel, 2019). After minimal rainfall in 2017, it was clear that Cape Town was seeing the driest three-year period on record (Wolski, 2018); climate change was estimated to have tripled the drought’s magnitude (Otto et al., 2018). Only through disaster declarations and massive efforts from municipal authorities, businesses and residents to reduce daily consumption to below 50 litres per person did the city manage to avoid ‘Day Zero’ – the day as of which households’ only access to water would have been from public taps, limited to daily rations of 25 litres per person (Department of Water and Sanitation, City of Cape Town, 2018; Ziervogel, 2019a). The experience was, in many ways, a city-wide trauma; however, hundreds of thousands of Capetonians living in informal settlements already queued at taps for their water before the drought hit, and inferior infrastructure still leaves many areas historically designated for non-whites particularly vulnerable to seasonal flooding, sewerage blockages and leaking pipes (Enqvist & Ziervogel, 2019; Mahlanza et al., 2016).

The SenseMaker project was initiated partly to meet a local CBO’s need for better evidence to support their arguments when interacting with representatives of the municipal authority. On paper, Cape Town’s municipality seeks to reinvent water governance and increase water resilience by promoting a ‘whole-of-society’ approach aimed at building collaboration and trust between city government and the public (City of Cape Town, 2019; see also Enqvist & Ziervogel, 2019). However, although civil society organizations in the water sector do exist, there is little precedent for effective public-civic partnerships, and the legacy of neglecting low-income areas represents a tremendous hurdle.

2.2. Learning through collaborative research

The different phases of the SenseMaker project provided opportunity for multiple stages of learning (recall Figure 2), described in points (a) to (f) below. These stages constitute the material analysed in this paper. The learning happened within and between the two groups of researchers: academics and activists (participating members of the CBO, also referred to below as ‘activist researchers’).

- (a) **Collectively framing the problem and mode of enquiry.** During the relationship-building and negotiations that preceded the project, and during its initial workshop in July 2019, the activist researchers learnt how to jointly identify what problem to focus on, and how to frame and study it. The CBO

members expressed a need to produce knowledge that could support their work, as well as a desire to learn how to do this themselves. These needs fitted well with our academic and applied interest in better understanding water issues in low-income areas, and in supporting community organizations working towards transformative adaptation (Ziervogel, 2019b). In the first workshop, the researchers jointly developed a SenseMaker-based approach that could be used to capture qualitative and quantitative information about people's lived experiences of water-related issues through narratives and signification or "meaning-making" questions to help with their interpretation.

- (b) **Engaging in structured enquiry.** During the fieldwork of collecting stories, the twelve activist co-researchers learnt about people's experiences and opinions on how to address water issues through 311 responses collected across the city (see Figure 3).
- (c) **Collectively reflecting on gathered information.** Learning took place through the sharing of thoughts, impressions and experiences in the workshops and during a 'care day'. This 'care day' was not initially planned but when people were struggling, we scheduled this day as an opportunity to share experiences, concerns and lessons about the interview and data capture process. Through the care day, practical issues were resolved. In the workshops and through Whatsapp group exchanges, queries were raised and experiences shared. Many activist researchers could identify with respondents' frustration with an unhelpful municipality, expressed in many stories, but there were also positive outcomes in the stories captured.
- (d) **Discussing implications and insights.** The second workshop focused on reflecting on the data and on extracting lessons relevant to the CBO's work on improving access to water services in low-income communities. The project findings indicate a dysfunctional relationship between citizens and authorities, with many of the qualitative narratives having described how multiple interlinked problems combine to build up frustration and a sense of abandonment among community members. Drawing on this material helped the activists identify different narratives to communicate their findings back to the studied communities and to the City.
- (e) **Internalizing and embodying knowledge.** During the second workshop and the subsequent sessions used to 'return stories' and present their findings to the studied communities and City officials, activist



Figure 3. Number of respondents interviewed across selected neighbourhoods in Cape Town.

researchers performed role plays to illustrate the situations people often find themselves in. Academics and activists collaborated to help capture and share the personal elements of the qualitative stories collected as well as quantitative evidence of the prevalence of themes across the sample as a whole.

- (f) **Teaching others.** Learning also happened by teaching others about the study during workshops, ‘story return’ sessions (see Section 3.1) and collaborative report writing, both internally within the CBO and with partner organizations. The activist researchers learnt about their own study by adapting their message for different audiences and by engaging in lively discussions with different groups including City of Cape Town officials, community members and other activists working on related issues.

3. Results

Below, we explore the process of knowledge co-creation as part of the community-level capacity building process (3.1), alongside the learning and emergent outcomes of the study (3.2), and through reflecting on empowerment as an element inextricably linked to this process (3.3).

3.1. Building capacity for knowledge co-creation

The desire to capture local knowledge about water-related issues in low-income areas underpinned this project. Despite decades of water justice activism, the CBO members expressed that little has changed, and that credible data is needed to engage with local government about the relevant problems. In response to the CBO’s request to learn how to undertake research to inform their advocacy and action strategies, the academic researchers proposed a research process that was then jointly and iteratively developed through each step shown in the top half of [Figure 2](#), drawing on knowledge co-production and epistemic justice principles.

Between the academics’ research experience and the activists’ problem-specific knowledge, finding a mutual understanding sometimes slowed progress in developing the SenseMaker tool collaboratively. Capturing and understanding different perspectives were critical, but created tension in some activist researchers who had to balance what they experientially ‘knew to be true’ with the need for collecting unbiased data. Developing the interview questions collaboratively required attention to both activists’ interests and to scientific principles for developing the most useful data. However, through the four-day carefully facilitated process, a signification framework emerged that satisfied both groups.

Conducting interviews and recording data provided opportunities for directly learning about research practices and the need to let respondents tell their own story, rather than guide them to confirm interviewers’ perspectives. The ‘care day’ proved valuable for joint learning and support, as one activist researcher confirmed: ‘I used to have anxiety about asking permission to interview, but now I have some steps to follow.’

The second workshop revealed that distilling higher-level insights from the SenseMaker data was challenging for the activist researchers. They extracted recurring themes and developed narratives for sharing these, while we as academics assisted by familiarizing them with how the quantitative data can be presented to inform an argument. Questions remain around how to involve community members with low levels of formal education in data analysis. Yet, the activists’ local knowledge about the issues are critical for putting forward adaptation responses that might be most effective in that locality. This highlights the mutual dependency between activists’ deep local knowledge and academics’ methodological and analytical skills. We believe that learning how to work with this tension of different types of knowledge is crucial for transdisciplinary work aimed at supporting greater individual and collective adaptive capacity.

The research process brought to light several challenges. Asking people about problems risks creating the hope that the project will change things. Living in the studied settlements themselves, many activists felt personally responsible. To some, the role of researcher added burdens to their already precarious lives: ‘I have collected stories, maybe ten. But I have been looking after my uncle who was sick and passed away, so I didn’t collect as many as I wanted to. And I lost my phone, so couldn’t upload them.’ Furthermore, although the SenseMaker project focused on generating credible information, translating the insights into practice is not straightforward. The bigger action learning process in which the SenseMaker project is embedded (recall

Figure 2) means that the project's data is being used to support action, both within the settlements where the research was undertaken and in collaboration with the City of Cape Town. Problems with billing, water management devices, sewage and supporting education in these settlements were some of the main issues that arose around which further actions are being developed. In addition, the CBO has continued to engage with the City during a critical time when the Water Department is developing implementation plans to support their new strategy.

While most activist co-researchers found the project rewarding, it also put significant strain on those with limited income trying to get by through means of piecing together work from a variety of sources. Different circumstances meant that some activists collected over seventy stories, while others only managed a handful. The CBO itself also struggled to keep clear the distinction and links between the research project and the broader action learning process. The organisation is a fragile social movement, with no paid positions. The members who participated in the SenseMaker project were paid stipends, which in some cases caused tension with other CBO members due to information about what activist researchers were compensated for (time spent collecting stories) and what not (attending the training workshops) having been poorly communicated. The research also put strain on us academics as much time was spent negotiating the project logistics and personal relationships. These are examples of some of the challenges of transdisciplinary research. Reaching across not only academic disciplines but also the boundary between academia and society is difficult and messy, particularly when working across wide income brackets (Moore et al., 2015).

3.2. Getting more than we bargained for

One of the goals of the next phase of support for capacity building under the UNFCCC is to provide more long-term support and locally-owned processes (Khan et al., 2020). Khan et al. (2020) suggest that strengthening civil society networks and partnerships should be a part of this goal. Through collaborative engagements and partnerships that are locally owned, anticipated outcomes (such as the knowledge that is developed) are often complemented by the unexpected lessons and interpersonal relationships that develop during the process (Collins & Ison, 2009; Emerson et al., 2012). Adaptive governance literature has shown how collective management has contributed to both the individual and group learning needed to build adaptive responses (Armitage et al., 2011; Folke et al., 2005; Plummer et al., 2013). In fact, it has been argued that learning itself is an adaptive behaviour (Pelling et al., 2008) and that social learning can help to integrate justice goals into water resource planning (Balazs & Lubell, 2014). Social learning approaches that support knowledge sharing and co-creation have increasingly been prioritized in the climate adaptation and resilience space (Ensor & Harvey, 2015; Kristjanson et al., 2014). Yet, understandings of how to support social learning and its intended benefits in the policy sphere are still limited.

As a transdisciplinary process with co-inquiry and co-learning at its heart, it was hard to predict exactly where learning might occur in the SenseMaker project. Considering the number of lessons that emerged alongside the project's objectives (see Table 1), both in terms of individual and collective learning, future capacity building projects for climate adaptation should anticipate that carefully facilitated processes will have rich learning outcomes. These need to be carefully held and shared.

At a systemic level, the project helped build trust and friendships across sociocultural divides, which enabled learning about each other's knowledge. The emerging social capital also strengthened relational competency, thereby enabling activist researchers to more easily draw on the expertise and skills of others in order to achieve previously impossible goals. This relational competency has already led to new possibilities for water governance by bringing the CBO into city-wide policy and planning activities.

3.3. Learning as empowerment

During and following the individual and collective learning that took place in the project, there were numerous shifts in the activists' sense of personal agency, collective legitimacy and relational capacity. These shifts relate particularly to how the activists engaged with others in their communities, with the academics and with City officials.

Table 1. The types of learning in the SenseMaker project.

Type of learning	Who was learning?	Was this type of learning an intended project aim?
Individual Learning		
(a) Learning how to conduct research	Activists & academics	Yes ^a
(b) Learning how to teach research skills to non-academics	Academics	No
(c) Learning about the subject of the research	Activists, academics & CoCT (City of Cape Town) representatives	Yes
(d) Re-learning personal identities	Mostly activists	No
(e) Personal reframing of 'the problem'	Activists & academics	No
Systemic/collective learning		
(a) Re-learning ideas and assumptions about expertise	Activists, academics & CoCT	No
(b) Learning how to apply community-generated data in formal decision-making structures	Activists, academics & CoCT	No
(c) Learning about each other	Activists, academics & CoCT	No
(d) Development of relational competency	Activists, academics & CoCT	No
(e) Collective reframing of 'the problem'	Activists, academics & CoCT	No

^aThe stated aim at the onset of the project was that the activists would learn, with support from the academic team. In the end, the academic team also learnt a great deal about conducting transdisciplinary research by partaking in this project.

The second workshop enabled the activist researchers to exhibit initiative and creativity by extracting key narratives from the findings and preparing short role plays to illustrate the main issues. These role plays, relying in part on posters with visualizations of quantitative data, became the main tool to share the project findings with other members of the CBO, City officials and members of the researched neighbourhoods. These 'story return' sessions, using the role plays, sparked rich discussions around resolving problems and preventing them in the future. As one activist explained, it was an empowering process: 'In the past, we had heard stories, but they weren't documented. But now we have them documented, so we can use them to support our advocacy.' This speaks directly to the activists' initial request to develop research capacity. Another activist explained, 'We have said these things every day. This [new data] is something different that we can go back to people with. With this SenseMaker course, we are getting there. It's going to take time, but we are going somewhere.'

The SenseMaker project connected the activists with six high-level City officials, invited by the academics to a briefing at the end of the second workshop. The substantive findings that the activist researchers were able to present allowed for a new type of interaction, one City official later stating, 'I actually came out of it on a high. It was such a good encounter, such a positive encounter. I felt that the way the community expressed themselves was clear but not attacking. That was really positive for me.' Another official pinpointed a key reason for the positive workshop outcomes, saying, 'I think there has been a lot of pre- and groundwork done before the meeting. There was a cohesiveness of a common goal.' In particular, the officials took an interest in the qualitative narratives captured in the study, as they provide a valuable complement to the City's own annual customer survey and align closely with the desire to adjust water governance to be more responsive to the needs of low-income communities.

The SenseMaker project directly addresses the City's new water strategy, which commits to 'an ongoing action learning research agenda in collaboration with relevant stakeholders [...] to improve water and sanitation services in informal settlements' (City of Cape Town, 2019b, p. 24), and to combining City- and community-generated data to enable 'better decisions on interventions in informal settlements' (City of Cape Town, 2019b, p. 44). Progress on both goals is still meagre, so a partnership with the CBO and drawing on their SenseMaker research could meet important needs – provided the appropriate mechanisms are developed. This includes empowering community-level organizations to participate fully in such partnerships. Already at the second workshop, City representatives were eager to share information with communities about how to interpret water bills and report problems, and to clarify what the City government can and cannot do. This positive response shows how transdisciplinary research can feed directly into shifting water governance through new networks and understanding between citizens and the state. Direct communication and planning between the City and the CBO followed the second workshop, but was unfortunately put on hold because of the COVID-19 pandemic.

Successful engagements often require adopting a new language. The CBO has tried to work with City officials for years, finally giving up in the absence of meaningful progress. The SenseMaker workshop seems to have changed this, with one activist saying, 'We've shifted from not wanting to work with the CoCT to thinking that it's best to work with the City, because being rebellious doesn't help us.' City officials' interest in data from a group of previously ignored, low-income residents represents a shift in power and legitimacy for the activist researchers, and is central to building the capacity of the marginalized to shift relational dynamics of exclusion (Grabowski et al., 2019). Adaptation policy could support this type of capacity building by requiring cities to include community-level data in their adaptation planning. There is, however, a need for caution, as when one hurdle is removed, another often emerges, as the aforementioned activist voices it: 'As much as we've come to the table, there are [still ward] councillors in our communities that are a big barrier. That's how it works; it is political.'

4. Discussion

4.1. Policy support for community-level capacity building

Given that capacity building support under the UNFCCC is such a common request from developing countries (Pauw et al., 2019), it is important to unpack what this support entails. Developing countries have identified the need to build community-level capacity for adaptation as a priority (UNFCCC, 2020), a need that our transdisciplinary study may help to fill. We illustrate that a carefully facilitated process of co-production can build collective power that can influence local policy and potentially lead to structural change in support of environmental justice (Balazs & Lubell, 2014). To support more of this type of intervention, a shift is needed in international guidance on capacity building for transformative adaptation across levels, from global to local.

In the urban sphere, a policy shift towards constructing shared knowledge of problems could help cities and residents build community-level capacity for transformative adaptation. Such collaborative approaches, however, often disrupt the status quo and interfere with established procedures, which can feel threatening to authorities (Lang et al., 2012a). Nonetheless, if calls for urban transformation and justice are to be heeded, more inclusive, multilevel processes are needed (Romero-Lankao et al., 2018) – and the policy landscape ought to better reflect this.

4.2. Building the capacity for collaborative knowledge creation

This paper argues that if more attention is paid to capacity building in the knowledge creation phase (recall Figure 1), the implementation of climate adaptation policies will have a greater chance of success. This is particularly important for transformative adaptation, where a careful reading of the current context – including its vulnerabilities, institutional arrangements, key actors and their preferences, and governance – needs to be well understood in order to address climate risk and issues of inequality and historic injustice (Shi et al., 2016). Such an understanding is promoted by the valuing of different types of knowledge, particularly experiential knowledge of the lived reality of residents, which help inform transformative adaptation strategies and strengthen resilience (Borie et al., 2019; Grabowski et al., 2019; Ziervogel, 2019b).

In adaptation policy, understanding and assessing vulnerability are key. However, vulnerability assessments are often academic exercises with limited involvement from diverse groups (Preston et al., 2011), and rarely followed by adaptation interventions. We argue that building a shared understanding of climate risk and social inequity between officials, practitioners, academics and the vulnerable themselves can help to capture an understanding of vulnerability that can then be easily integrated into adaptation action plans.

Sharing stories is one way of starting to shift invisible power to give a voice to those who are marginalized (VeneKlasen & Miller, 2003). The SenseMaker project is one example of how local data, including qualitative stories and quantitative information, can be captured, analysed and shared relatively rapidly by community members across multiple settings. The unforeseen ways in which our methodological approach helped shift agency and power to the community members (recall Table 1) is important, given that activist researchers with informal or experiential knowledge often feel alienated in collaborative research projects and therefore

withhold information (Roux et al., 2017). It also taught us as academics several lessons that strengthened our teaching skills, refined our methodological approaches and enriched our understandings of the field we work in. Last but not least, it opened a previously closed space in dealing with City officials and so started to shift hidden power structures (Gaventa, 2006). As such, the process initiated networks that can feed into emerging water governance in the city.

Universities and similar training institutions are key to capacity building and could play a stronger role in the future (Khan et al., 2020). However, given that only 10% of the 800 million youths projected to enter the job market in Africa over the next 30 years will have a tertiary qualification (Darvas et al., 2017; Losch, 2016; Minde et al., 2015), there is an enormous need to consider the meaningful inclusion of the remaining 90% in the imagining and construction of regenerative and resilient futures to respond to climate change. Transgressive alternatives to the existing capacity-building efforts are an essential addition to the formal training sector. Such alternatives can enable a ‘social ecosystems approach’ to learning in which local anchor institutions such as CBOs support horizontal networks of social partners to ‘connect the worlds of working, living and learning’ (Hodgson & Spours, 2018, 46). This is likely to increase the development and diffusion of new and more varied kinds of knowledge and competencies across the Global South, enhancing the ability of communities to respond to climate change.

We argue that there is a need for less intensive but more sustained processes of collaborative, life-long learning that position adaptive and transformative capacity as a communal competency. This could support place-based responses to help those affected by climate change overcome the shocks and adapt to slow change. Radically expanded access to technical research skills such as those needed for data collection, analysis and sharing is critical to creating inclusive and democratic knowledge economies, and aligns with demands from developing countries (UNFCCC, 2020).

4.3. Supporting adaptation through knowledge creation and learning

Capacity building for transformative adaptation, by its nature, requires the integration of different types of scientific and societal knowledge (Lang et al., 2012). Careful preparation and implementation are critical to ensuring that capacity building supports collective problem re-framing, while building agency and relational capacity, which are essential for transformative adaptation. Stakeholders and academics might have different roles to play at various stages of knowledge co-creation. Local stakeholders are particularly relevant in the initial co-design and definition of the research questions (Mauser et al., 2013). Academic engagement is useful during the conceptual development of research questions and bringing in different disciplines. Stakeholders then need more responsibility when it comes to disseminating results and using these to plan and implement adaptation responses. As is evident in our Figures 1 and 2, the SenseMaker project therefore only constitutes a small segment of the larger process of capacity building (Figure 4). The engagements that took place before the SenseMaker project were central to building relationships and to enabling the envisaging of the appropriate type of knowledge creation. Going forward, the results, lessons and relationships gained from the project will feed into the ongoing action research and into community activists’ contributions to water governance in Cape Town.

Our case study adds to a growing body of empirical evidence that complements the theory arguing for transdisciplinary approaches. Global sustainability research programmes like Future Earth advocate for transdisciplinary approaches that provide ‘knowledge that is better able to contribute to the development of robust policy solutions and their effective, equitable implementation’ (Mauser et al., 2013). We demonstrate one approach that can be used for integrating activists’ rich experience in working on water-related issues in low-income communities with authors’ familiarity with scientific enquiry. After the knowledge creation phase, we, as academics, stepped back to primarily lend support to the CBO in its continued use of the data and engagements with other organizations, including the City, to implement adaptation responses. The value of a rigorous research method to underpin co-learning became evident in our case. A process that builds trust and legitimacy can help to prevent conflict arising from potentially controversial insights. In our case, this process may have been further strengthened by the nature of the data emerging from the process, which combined quantitative rigour with descriptive personal narratives. Compared to previous

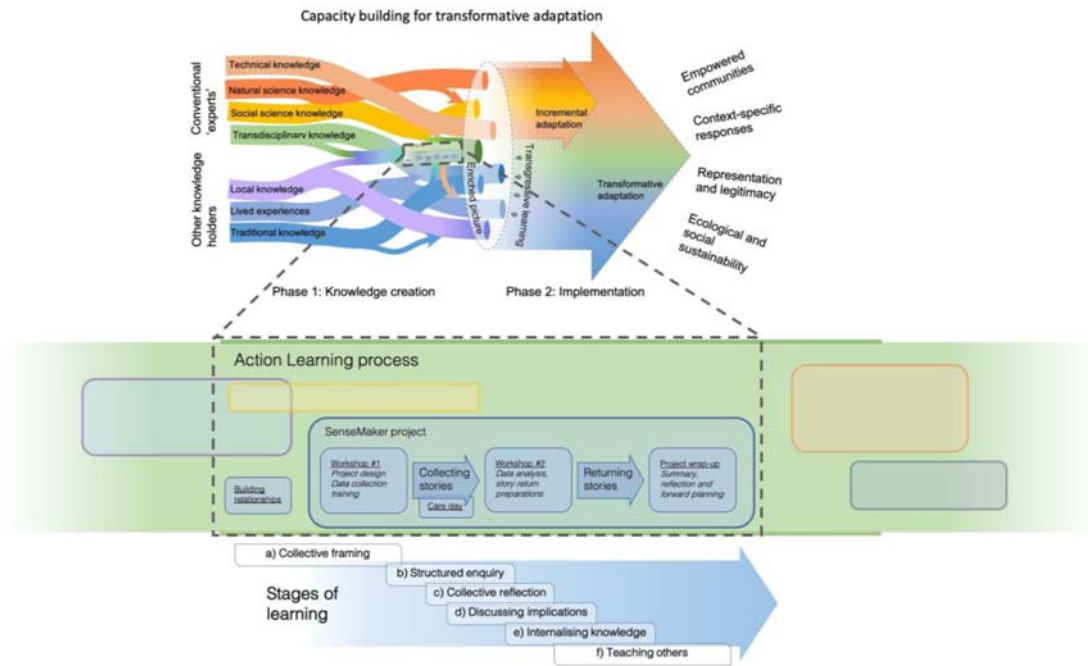


Figure 4. The SenseMaker project took place within a broader action learning process, which in itself forms part of the knowledge creation phase of capacity building.

engagements between the City of Cape Town and the CBO, the SenseMaker project saw co-produced knowledge emerging as a platform for empathetic understanding of one another's challenges, which shifted away from blaming and finger-pointing and supported community-level empowerment. This type of inclusive multi-level governance is critical to the success of attempts at building capacity for adaptation responses (Adhikari & Taylor, 2012; Ziervogel, 2019b). The growing policy support for vertical integration in adaptation could be used to explore and strengthen opportunities for collaborative and transgressive learning as part of multilevel adaptation governance.

5. Conclusions

Capacity building for transformative adaptation is key to meeting global climate and sustainability goals. These include, among others, goals under the UNFCCC and Paris Agreement, as well as the Sustainable Development Goals for climate action and reduced inequality. While it has been argued that those who stand to benefit most from these targets should be given opportunities to share their knowledge about how to reach them (Grabowski et al., 2019), limited guidance exists on how exactly community-level capacity for transformative adaptation can be factored into policy responses at various levels. Processes that present a platform where marginalized perspectives can be amplified help build a richer system understanding (Armitage et al., 2011). Such transformative transdisciplinary processes can also serve to rebuild trust by making the marginalized feel heard, contribute to shifting hidden power structures, and help identify opportunities to change the status quo and start addressing past injustices. We therefore argue that capacity building efforts, *especially in the context of transformative adaptation*, will be better equipped to confront inequalities and power dynamics if they are informed by processes that acknowledge and engage with locally relevant and sourced knowledge and knowledge systems. This does not merely underpin adaptation work, it is part and parcel of it.

This paper presents two areas for consideration when developing community-level capacity for transformative adaptation, based on a case study of water services in low-income urban settlements. Firstly, our study

shows how pedagogical approaches that focus on collaborative knowledge creation (rather than knowledge dissemination or transfer) can contribute to capacity building by supporting a more nuanced understanding of local problems. This understanding can, in turn, support the development of more relevant context-specific adaptation responses. Secondly, taking a transdisciplinary approach that collaboratively develops, as part of an ongoing governance process, knowledge situated at the community level, can result in a range of outcomes beyond those originally envisioned. Such outcomes include reciprocal learning and empowerment, which can help to embed and sustain community capacity for transformative adaptation. This type of locally-embedded and long-term capacity is what many developing countries have requested strengthened support for under the UNFCCC.

To us, what stands out as perhaps the strongest indication of the value of co-creation of knowledge is how it strengthened the legitimacy of both individuals and the CBO as an organisation. This has, in turn, given the CBO a 'seat at the table'; in a system in which contributions to urban policy are largely driven by invitation, the CBO is now viewed by the City as an unexpected but valued guest. This unexpected value of the process (beyond the primary/foreseen) draws attention to the shifting roles and new relationships formed between local government, CBOs, community members and academics. Policies, research programmes and activist strategies that create spaces for collaborative learning and experimentation might facilitate trust-building and a sense of partnership more easily than can approaches where the objectives are rapid problem-solving or increased participation for its own sake. This is particularly important when working on adaptation projects in highly unequal contexts, where the challenge is not limited to simply getting previously excluded actors a spot at the negotiating table. Equally important is equipping them with the skills to substantiate their arguments in ways that other stakeholders trust and understand.

Acknowledgements

The authors would like to thank the CBO and its members, without which this research would not have been possible. We are also grateful for the residents who took time to share their stories and answer questions about their situation in low-income settlements. The action learning and SenseMaker project was funded by a grant from the AXA Research Fund.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by AXA Research Fund.

ORCID

Gina Ziervogel  <http://orcid.org/0000-0003-4219-6809>

Johan Enqvist  <http://orcid.org/0000-0002-6300-0572>

Luke Metelerkamp  <http://orcid.org/0000-0003-1407-7693>

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