Advancing neighbourhood climate action: opportunities, challenges and way ahead

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Abstract

Cities are emerging as key sites for action on climate change. Within cities, urban neighbourhoods are increasingly taking leadership in addressing local effects of climate change through mitigation and adaptation projects. Bottom-up action on climate change through neighbourhood scale initiatives presents opportunities in terms of getting the community to partner and participate in climate action. However, neighbourhood scale initiatives often run into challenges in terms of limited participation, impact and resources to keep the programs running. In this paper, we advance the literature on the opportunities and challenges of neighbourhood scale climate action. We do so by analysing three neighbourhood scale initiatives that address climate action in Canada and in Australia. We adopt online workshops as a research methodology where volunteers from the three initiatives share their experiences of opportunities and ways of overcoming challenges of neighbourhood climate action. Our findings indicate that collaborative governance between the city and the neighbourhoods, incremental community building and consolidating local resources are important for advancing neighbourhood climate action. This paper adds to the thin body of knowledge on neighbourhood scale climate action and presents ways of overcoming the challenges of bottom-up climate action.

Keywords:

Climate action, neighbourhoods, bottom-up, multi-scalar governance, local planning

1. Introduction

Cities, directly and indirectly, contribute to around 50% of global greenhouse gas emissions (GHG) (IPCC, 2018; Moran et al., 2018; United Nations, 2019). Owing to this, cities are increasingly recognised worldwide as an optimum scale for framing policies and plans for local action on climate change (Bulkeley et al., 2011; Hughes, 2019). Consequently, multiple cities across the world now have dedicated climate action plans with concrete strategies for the mitigation of GHG emissions and adaptation to the impacts of extreme weather events (Hughes, 2019). The focus on cities as sites of climate action has also elicited increasing interest in understanding the role of urban neighbourhoods in participating in or leading bottom-up climate action within cities (Grazieschi et al., 2020; Joshi, Agrawal and Lie, 2022). Neighbourhood scale climate action includes efforts by urban communities to address climate change. These actions range from GHG mitigation efforts through investment in low-carbon buildings, promoting active transportation and adopting renewable sources of energy (Evola et al., 2016; Joshi, Agrawal and Welegedara, 2022; Palermo et al., 2018). They also include adaptation efforts like flood mitigation measures, reducing urban heat island effects by increasing green spaces and collective water conservation measures (Evers et al., 2016; Maragno et al., 2020).

Bottom-up initiatives at a neighbourhood level present opportunities for collective community action to address the impacts of climate change (Aylett, 2013). These initiatives bring neighbours together and build a sense of mutualism that contributes towards developing social capital (Aldrich and Meyer, 2015; Broska, 2021). Neighbourhood climate action is also a realization of bottom-up democracy and decentralization of power (Bradley et al., 2017; Cloutier et al., 2018; Sawhney et al., 2015). However, neighbourhood scale efforts may run into challenges in initiating and maintaining projects on climate action because of limited power, resources and agency at the neighbourhood level. Additionally, inequalities may exist

in terms of which neighbourhoods act on climate change and within these neighbourhoods, which group of people participate in and benefit from climate action (Gilderbloom et al., 2017; Meyer et al., 2018; Passe et al., 2020).

Building on a recent literature review on neighbourhood climate action (Joshi, Agrawal and Lie, 2022), we advance the current knowledge on the challenges and opportunities of locating climate action at a neighbourhood scale. We do so by presenting three case studies of neighbourhood climate action located in Canada and Australia. We adopt online workshops as a research methodology inviting the key-representatives of neighbourhood climate action programs to present the opportunities and challenges of their programs as well as to share and deliberate upon potential ways forward to overcome the challenges of acting on a neighbourhood scale. Our research is driven by three key questions:

1. What opportunities and challenges are identified by neighbourhood climate action programs?
2. How were those challenges overcome?
3. What lessons can be learnt for advancing neighbourhood climate action based on the experience of the selected programs?

In the following section, we elaborate upon the opportunities and challenges of neighbourhood climate action, based on existing academic literature. In section 3, we introduce the three case studies and elaborate our methodology on using online workshops as a mode of data collection. In section 4, we present our findings based on a content analysis of the workshop inputs. We conclude in section 5 with key recommendations for advancing neighbourhood climate action. Our findings build upon the opportunities and challenges identified in academic literature as well as presents ways in which neighbourhood scale programs navigate the challenges and work towards initiating and sustaining climate action.

2. Neighbourhood as a scale for climate action

Neighbourhoods are distinct physical and social blocks of a city (Rohe, 2009). On the one hand, they are composed of physical aspects like buildings, streets, infrastructure and vegetation (Wang et al., 2016). On the other hand, they are also constituted of complex social relationships between residents contributing to a shared neighbourhood identity (Rowlands, 2011). The physical and the social aspects of neighbourhoods and their interplay are at the centre of any bottom-up, neighbourhood scale endeavour from urban regeneration (Rohe, 2009; Rowlands, 2011) and sustainability (Grazieschi et al., 2020; Luederitz et al., 2013) to present day efforts towards addressing climate change through mitigation and adaptation measures (Cloutier et al., 2018; Maragno et al., 2020; Palermo et al., 2018).

Addressing climate action at the neighbourhood scale brings together two strands of scholarly knowledge. The first one is on bottom-up action towards sustainability in general and climate change in particular (Seyfang and Smith, 2007; Shaw et al., 2018). The second one on neighbourhoods as a fundamental unit of planning and organisation in a city (Bradley et al., 2017; Rohe, 2009). Based on a reading of literature on bottom-up climate action and neighbourhood planning (Joshi, Agrawal and Lie, 2022), we identify key opportunities and challenges for initiatives aiming to address climate change at the neighbourhood scale.

2.1 Opportunities:

a) Optimum scale: Some scholars argue that within the structure of a city, the scale of the neighbourhood is optimum for bottom-up climate action. From a physical perspective, this is because a neighbourhood is large enough to have its own urban design strategy (Oliver and Pearl, 2018). From a social perspective, this scale is easily recognizable for people and is situated where they are likely to have existing social networks and connections (Rohe, 2009). From a multi-scalar perspective of action on climate change, the neighbourhood scale is

ideally positioned for community action, between top-down action by the government and bottom-up action by individuals (Aylett, 2013). The scale of the neighbourhood received renewed attention during the COVID-19 pandemic, when residents spent extended amounts of time within their local communities and possibly had a chance to reconnect with their immediate surroundings (Joshi et al., 2020; Joshi and Wende, 2022; Moreno et al., 2021).

b) Mutualism and social capital: Given that the lives of residents are often socially linked to their immediate surroundings, a collective neighbourhood identity and bonds lend themselves as a foundation for climate action (Hielscher et al., 2011; Rees and Bamberg, 2014). Existing social networks within the neighbourhood may provide support to climate action projects (Joshi, Agrawal and Welegedara, 2022; Middlemiss, 2008). Social capital, or the advantages that residents draw from being part of a social group, could help mobilise people for climate action projects (Aldrich and Meyer, 2015; Broska, 2021; Purdue, 2001).

c) Realising bottom-up democracy: by engaging residents as active participants in responding to climate change, neighbourhood climate action is recognised by some as a means for actualizing bottom-up democracy in a city (Bradley et al., 2017). This pushes the multi-scalar perspective further to include neighbourhoods in climate action planning. Existing literature presents multiple means by which residents participate in climate action: from informal projects (Cloutier et al., 2018; Sawhney et al., 2015) to formal integration in the city's planning system (Bradley et al., 2017).

2.2 Challenges

a) Sub-optimal scale: A counterargument to the neighbourhood being an ideal for climate action is that neighbourhood projects are often small-scale and short-term, failing to create tangible impact (Cloutier et al., 2018; Murota, 2014). Furthermore, urban planning is often

within the purview of the city governments, making neighbourhood scale action an informal and sporadic activity (Sawhney et al., 2015). This ties back to a larger debate on the optimal scale for a large-scale global problem like climate change (Gupta, 2007). With no formal mandate to act on climate change, neighbourhood scale activities remain volunteer led projects creating limited local impact (Smith et al., 2013; Taylor Aiken, 2014).

b) Social challenges: All neighbourhoods in a city are not equal nor are residents within the same neighbourhoods (Wittmayer et al., 2014). Existing literature points out that vulnerable neighbourhoods often lack resources for organising climate action projects (Gilderbloom et al., 2017; Hendricks et al., 2018; Meyer et al., 2018). Among neighbourhoods where climate action is organised, only dominant interests and voices within the community might be represented (Purdue, 2001). Neighbourhood climate action thus runs the risk of recreating socio-economic inequalities that exist within the city as well as within neighbourhoods themselves (Anguelovski, 2015).

c) Power and resources: The power and resources for neighbourhood planning have traditionally been concentrated at the city level (Rohe, 2009). While climate change creates new expectations of bottom-up action from neighbourhoods, there is a mismatch when it comes to the power and resources available at the neighbourhood level for such action (Büchs et al., 2012; Lufkin and Rey, 2014). Tax collection, building and development bylaws formulation and budget allocation largely happen at the city level (Rohe, 2009). Furthermore, data and knowledge needed to frame climate action might not exist at the neighbourhood scale (Pulselli et al., 2018; Welegedara et al., 2021). Resources to collect and analyse this data might also be missing at the neighbourhood scale. There are also instances when neighbourhood climate action clashes against the developmental mandates being set at the city and regional scales (Elwood, 2002; Rowlands, 2011).

Table 1 below summarises the contrasting opportunities and challenges identified for acclimate action at the neighbourhood scale. To build on the opportunities and challenges of neighbourhood climate action as well as to explore ways of overcoming challenges, we analyse the experience of three neighbourhood action programs in Canada and Australia.

Table 1 Opportunities and challenges of neighbourhood climate action

Opportunities	**Challenges**
Optimal scale: physically and socially tangible for residents	Sub-optimal scale: small scale and short term action
Mutualism and social capital: neighbourhoods have strong social networks	Social challenges: reproduction of socio-economic inequalities.
Realizing bottom-up democracy: participate in decisions on climate change	Power and resources : largely concentrated at the city scale

3 Methodology

The data for this research was collected as part of a one-year transdisciplinary project on neighbourhood climate action (identifier removed for the review process). The objective of the project was to co-create knowledge on identifying the opportunities and challenges of neighbourhood climate action as well as develop ways of overcoming the identified challenges. The research was carried out in collaboration with a neighbourhood climate action program in Edmonton, Canada, called Green Leagues (EFCL, 2019). The research was carried out in three steps.

3.1 Identifying neighbourhood climate action initiatives

To build on the experience of the Green Leagues program, we identified ten neighbourhood action programs across the globe through an internet based search. Programs were selected if they worked at a neighbourhood scale, worked on adaptation and/or mitigation measures for climate change, adopted a bottom-up approach of working with residents, had contact information available and were conducted in English. We restricted our initial search to ten programs as we were working within the frame and budget of a one year program. We then reached out to the program contact points via email for participation in this research. Two programs, in addition to Edmonton's Green Leagues, agreed to participate in the research. Here we present a short introduction of the Green Leagues program, who were collaborators in this research, as well as the two invited programs:

3.1.1 Green Leagues, Edmonton, Canada

The Green Leagues program was started in the year 2016 as part of an initiative by the Edmonton Federation of Community Leagues (EFCL). EFCL is an umbrella organization for 161 neighbourhood associations called Community Leagues (CL) in Edmonton, Canada (Kuban, 2005). The Green Leagues program assists CLs across Edmonton in their efforts to address climate change through mitigation and adaptation actions like switching to solar energy, conducting energy efficiency audits of community buildings, community gardening and creating awareness about sustainable water and waste reduction practices (EFCL, 2019; Joshi, Agrawal and Welegedara, 2022). The Green Leagues program is led by an Energy Transition Officer (ETO) working with representatives on neighbourhoods known as Sustainability Directors. Eight Sustainability Directors (SD) participated in this research representing the experience of their respective neighbourhoods in Edmonton. The SDs were key-informants in this research, contributing through their experience of having worked at the neighbourhood scale.

3.1.2 Ecoburbia, Australia

Located in a suburb of Fremantle in Australia, Ecoburbia started in 2013 as an initiative focused on creating more resilient communities in response to the challenges presented by climate change and peak oil (Ecoburbia, 2018). Led by Shani Graham and Tim Darby, Ecoburbia functions as a community hub, micro-farm, and urban infill development site (RTMI University, 2019). Ecoburbia's building has been retrofitted with sustainable solar power sources and water collection and dispersal systems. The 1960's home is an alternative to infill development, and since the home's footprint has not increased, despite the increase in population density, there is space for a 350 square metre garden that has chickens and goats (RTMI University, 2019). Ultimately, Ecoburbia is described by its creators as not only a property but a hub committed to educating the community in which it is located and building resilience through workshops and events (RTMI University, 2019).

3.1.3. The Resilient Streets Program, British Columbia, Canada

The Resilient Streets Program is part of the Building Resilient Neighbourhoods (BRN), which is a collaborative effort launched in 2012 to build resilient communities and neighbourhoods in the Greater Victoria region in British Columbia, Canada (BRN, 2021). The program is aimed to strengthen street level connections between households, build relationships between neighbours, and promote cooperation and mutual support during emergencies. The initiatives include multiple public events such as celebratory gatherings (potlucks and fests), rooftop gardening, wall mural paintings, local scaled street interventions (such as landscaping and traffic calming), tools sharing and skills exchange, as well as sharing individual and household stories with the community through an online platform. The program is operationalized through various awareness workshops and micro-grants (financing) which act as kick starters to small scale projects initiated by the residents (BRN, 2021).

3.2 Workshop as a research method

A workshop is defined as a *"means an arrangement whereby a group of people learn, acquire new knowledge, perform creative problem-solving, or innovate in relation to a domain-specific issue."*(Ørngreen and Levinsen, 2017). Workshop is a co-creation research methodology (Wittmayer et al., 2017) that aims to add to the participants knowledge about a certain domain as well as produce data about the domain in question (Ørngreen and Levinsen, 2017). Workshops, conducted in an online environment, gained relevance as a method of data collection in social sciences during the COVID-19 pandemic (Shamsuddin et al., 2021).
For our research, we designed and conducted four online workshops between May and October 2021 on Zoom. The first three workshops were spotlight workshops where each of the participating programs presented their work and ongoing projects. The presentation provided an impulse for a discussion on the opportunities and challenges of the project. As well, it led to participants sharing their own experiences from engaging in neighbourhood climate action initiatives. The final workshop was a synthesis workshop where Sustainability Directors from the Green League program, who had participated in the previous workshops, reflected on the information shared from the previous workshops as well as developed pathways for moving forward. Table 2 summarises the structure, objectives and the participation in the four workshops.

The workshops were collaborative in nature (Ørngreen and Levinsen, 2017), with the researchers leading the workshops while remaining open to the participants' inputs. The first three workshops used question and answer format (either through the microphone or through the chat function) and the fourth workshop used Miro, an online collaborative whiteboard, to collect participants' inputs.

Table 2 Structure, objectives and participation in online workshops

Date (2021)	Title of the workshop	Structure	Key objectives	Number of participants
May 26	Yes, energy transition in my backyard	30 minutes presentation on the Green Leagues program and projects followed by a 30 minutes discussion with the participants in a question-answer format.	Identify the key opportunities and challenges of the Green Leagues program. Identify ways in which the Green Leagues program overcame challenges.	Presenters: 2 SD: 8 EFCL representatives: 1 Research team: 3
June 22	Let's talk community: Ecoburbia	30 minutes presentation of the Ecoburbia program and projects followed by a 30 minutes discussion with the participants in a question-answer format.	Identify the key opportunities and challenges of the Ecoburbia program. Identify ways in which the Ecoburbia program overcame challenges.	Presenter: 1 EFCL: 1 SD: 7 Research team: 4
August 10	Resilient Streets program	30 minutes presentation of the Resilient Streets program and projects followed by a 30 minutes discussion with the participants in a question-answer format.	Identify the key opportunities and challenges of the Resilient Streets program. Identify ways in which the Resilient Streets program overcame challenges.	Presenter: 1 EFCL: 2 SD: 5 Research Team: 3
October 13	Co-Creating Neighbourhood Climate Action Strategies	Interactive 1.5 hours workshop where the research team collected inputs from the participants.	Collect inputs on participants regarding the 6 opportunities and challenges identified in literature. Collect input from the participants on ways they have/can overcome the identified challenges	EFCL: 2 SD: 7 Research Team: 3

3.3 Data analysis

The workshops produced 4.5 hours of recordings that were transcribed and transferred to NVivo, a qualitative analysis software. We adopted a thematic analysis approach to analyse the data (Braun and Clarke, 2006). We first deductively coded the transcripts on six broad themes of opportunities and challenges identified through the literature review. Further, we inductively coded the transcripts for new and emerging themes of the opportunities and challenges of neighbourhood climate action. Finally, we added the additional theme of 'solutions' that the participants shared with regards to the challenges that they identified.

In accordance with the ethics approval of this project (project number to be inserted after the review process), we sought prior permission from the participants regarding their inputs being recorded on Zoom and for post-workshop analysis for a scientific paper. We have identified the participating programs with their consent, however we have kept the exact identities of the participants anonymous.

3.4 Limitations

We identify three limitations in our research design. First, the data was collected as part of a one-year project, limiting the amount of time that we could allocate for workshops and the number of programs that we could invite. Second, given that this research was conducted during the COVID-19 pandemic restrictions, we were limited to the use of digital means of communication for inviting participants (emails) and conducting the workshops (Zoom). Finally, our participants were largely volunteers from the neighbourhood organisations and had competing demands on their time from their jobs and household responsibilities. We selected a one hour long format during lunchtime based on a pre-workshop survey with the participants on the best suitable time and duration.

4. Findings

Based on the input of the workshop participants, we identify the following opportunities and challenges for neighbourhood climate action projects:

4.1 Opportunities

Based on our analysis, we identified three main opportunities that can be used as useful starting points for neighbourhood climate action.

4.1.1 Optimal scale: First, several participants discussed a variety of reasons why neighbourhoods are an optimal *scale* for local level climate related decision making and implementation. For example, one of the SDs mentioned how communities are the *"nexus for everything that happens in society"*, thus any meaningful urban climate action framework must accommodate community interests. Another SD emphasized how the community leagues have now existed for decades which makes them more reliable from residents' perspective compared to other organizations at different scales of governance. A SD highlighted how the neighbourhoods present a unique opportunity for entry points for new action, since the possibilities of community league specific actions are largely missing from climate action across cities:

"I would say that the scale at which they (community leagues) operate, which is the neighbourhood scale, that is a very important and an unrepresented scale at urban level when we talk of energy transitions"

Talking about the foundations of the Ecoburbia program, the presenter described how the neighbourhood scale can be most useful to consider while planning for emergencies and extreme events, since often the community members can provide the quickest response before formal help arrives. They said:

"In some sort of crisis, whether it be bushfires, floods, [the] majority of the help within the first 48 hours most often comes from within your geographic community, within one kilometre from your house."

4.1.2 Mutualism and social capital as co-benefits: The second opportunity that the participants described was that many of the community level actions can have *co-benefits* that can be seen in terms of positive benefits in terms of social well-being of residents. A presenter from the Resilient Streets program pointed out the following:

"Climate related challenges intersect with other challenges, so we are looking to build resilience not just to acute stresses and weather events, but also to other challenges such as social isolation, social equity and health challenges."

4.1.3 Bottom-up democracy: The third opportunity, building on co-benefits, is also key in making community climate actions more socially rooted, thus strengthening local democracy in the city. Participants noted that harnessing volunteers, providing small financial grants as well as facilitating social events regularly can promote more connectedness between neighbours, which can be a crucial factor during emergencies as well as in fostering long term community resilience. A participant in the Resilient Streets program described the variety of actions that have been initiated to foster more community connectedness:

"We engage neighbours through workshops to learn about ideas, and then we offer support through small grants to remove financial barriers for people to take action….Many local activities such as block parties are foundational strategies for building neighbourhood resilience."

"When we first started Resilient Streets, our first project was building up a program called transition streets… ..this is a deeper dive into sort of neighbours choosing to come together to learn about opportunities for energy transition."

4.2 Challenges

In analyzing the workshops, we find that three categories of challenges emerged across the sessions – social, scale, and power and resource challenges. The following section explores these in detail.

4.2.1 Sub-Optimal Scale: Currently, our workshop participants noted that city processes and procedures are a barrier to implementing climate action in communities. One participant highlighted the challenges in getting approvals for these actions, saying:

> "*It has been difficult to make [adaptation and mitigation projects] happen because the city process is cumbersome.*"

Further, internally, city processes that are not integrated can also slow down the progression of climate action. This internal inaction has meant that we see a silo-ing of the best intentions and initiatives, which are not necessarily having an integrated and joint approach

Finally, capacity, and specifically the capacity of neighbourhood volunteers to undertake advocacy under current governance structures, also came up as a challenge to implementing climate actions. As one workshop participant said "*[t]here is only so much volunteer capacity to advocate for specific things."* Current processes and procedures may intentionally or unintentionally limit climate action at the neighbourhood level because people in communities have *"limited capacity for advocacy."*

4.2.2 Social Challenges: Based on our workshops, we found that socio-cultural challenges posed a significant role in the implementation and success of neighbourhood climate action work. Politics at the provincial, municipal, and local levels all influence people's willingness to accept and undertake different neighbourhood climate action work. Participant narratives suggested that competing socio-political interests can lead to inaction or slow the progress of

implementing these actions. A workshop participant who had worked to install solar panels on their community league building in Edmonton highlighted this challenge, saying *"one of the people who has very strong connections with the current government, sent me an email congratulating me personally, but said I prefer to burn fossil fuels."*

The quote highlights that neighbours, like cities, might have divergent political orientations (Joshi and Agrawal, 2021) that in turn might influence their support or dissent for neighbour climate action.

We also found that a key determinant of neighbourhood climate action is the social and behavioural norms that are dominant within communities. In the cases we studied, the social norms, specifically present within western cultures were a barrier to implementing actions that are considered to be beneficial to climate change adaptation and mitigation. As a result, the activities and methodologies prominent in neighbourhood climate action work often push against social norms and, as described by one participant, *"tendency in western cultures to look for technological solutions to social problems."*

One workshop participant spoke to the shift in behaviours that is necessary to enact meaningful climate action that neighbourhood organizations intend to undertake:

> *"There are so many cultural shifts that are needed because right now I feel that I would have a hard time convincing my neighbour to share even a lawn mower with me because my neighbour might not want to be beholden to me."*

The case of the Ecoburbia program in Australia was also faced with similar challenges. The group has since worked to overcome them by building relationships between community members prior to discussing climate-related actions.

4.2.3 Power and resources : With power traditionally concentrated at the city level, neighbourhoods have experienced both financial and informational challenges when undertaking or planning for climate action.

Because *"[t]he idea of planning at the neighbourhood level is new to Canada,"* often these neighbourhoods lack power within current city processes to initiate, plan and execute projects. Thus, they do not have the autonomy to undertake climate actions or there is ambiguity over the neighbourhood's role in such actions. One workshop participant in Edmonton suggested that instead of telling the neighbourhood what the project or upgrade will be we should examine:

> *"How [can we] shift conversation in neighbourhoods to allow people to participate in that early process of deciding what is important and creating buy in that way."*

Currently, workshop participants in Edmonton highlighted the process that must be undertaken when following established governance structures.

> *"It is basically residents coming together and making their voices known to the city administration and beyond, is the only way to get ideas forward [. . .] neighbourhoods are not legal [entities] in any shape or form in the Canadian context."*

Without shifts in this governance structure, neighbourhoods are restricted by the city processes and procedures, resulting in delayed action and disempowered community members.

A major challenge for neighbourhoods looking to implement climate actions was the lack of data and information at the neighbourhood scale. As one research participant noted the city typically does not either collect data or make it publicly available at the neighbourhood scale, possibly owing to privacy and confidentiality concerns. Thus, as our participants noted

"[d]ata is a big challenge" that needs to be addressed because *"[i]f people don't have the information [from cities] then those decisions aren't going to get made."*

Workshop participants also noted the role that money and finances play in actualizing climate action. Funding at both the city and neighbourhood level have an impact on the feasibility of these projects. In one of our workshops, the participants highlighted the need to *"remove financial barriers [in order] for people to take action."*

However, some participants have found work-arounds to these constraints. This is seen in the following quote from a community organizer: *"money is a resource that you might not even need."* Furthermore, speaking to the issue of power at the neighbourhood scale they offered an alternative vision saying that *"permission needs to be granted by the people who are impacted, not the city."*

4.3 Overcoming challenges

The workshops opened a space for participants to put forth ways to overcome barriers of climate action at the neighbourhood scale drawing from their experience. Here we summarise the key themes that emerged during the workshops.

4.3.1 Collaborative governance: To overcome the problem of scale, participants suggested utilising scalar dynamics at the city level, given that the city has greater capacity and organizational power. This was indicated by the Green Leagues program as they explained that they:

> *"Would love to see the city drive some of it [clmate action], and say like these are all of the categories where we could do better on climate intervention and kind of treat*

the best climate strategies as standard, rather than as an upgrade to be advocated for [at the neighbourhood level]"

The Green League program advocated for the city to create better opportunities for neighbourhoods to engage in climate action, specifically through educating neighbourhoods of their options during city-led processes. For example, during city led renewal our research participants suggested that we "*need to make sure people are educated about options and what they mean"* – the city or community league can come in and work with the city and *"say look we also want either efficient options if they're not there or if they are there we want people to understand why they are there, what benefits those have as opposed to others, and at what costs"*

4.3.2 Incrementally building community: A common theme among several participants' responses was the necessity to adopt an incremental approach at the community level to overcome challenges. The participants noted that this approach can be an effective way in exploring possibilities and range of adaptation options, as well as to validate initial ideas that may have potential to scale up at a later stage. Participants described how local block level social events can be a useful *"foundational strategy for building neighbourhood resilience"*, having potential to develop *"social connectedness between people within the community"*. Local household communication is key to achieve the above, and can spark other varying scales of actions. A participant from Edmonton reflected on the importance of informal discussions to spark important discussion on risks and possible solutions:

"You get people together with these topics that even if it's totally tangentially related, and just get people in the same room, sitting together and then maybe someone really likes the Coyote talk, so they come to the next one on flood mitigation and insurance

policies and they find that really interest.. ...I think it is just about giving people all the different options they can to get them interested."

This was further explored in the Ecoburbia, Australia program, as they worked to incrementally build community through social activities saying that at the beginning of their program they"

"Weren't talking openly about climate change, about peak oil and resource depletion, about sharing resources. None of those things were spoken about out loud, but they were still there in the activities we had"

Given current governance structures and city processes, the Edmonton's Green League program emphasized that *"proactive engagement of bringing together"* communities may be important instead of waiting for the City to do so when a decision needs to be made. If relationships aren't built before, it may become challenging to come to a consensus. Thus, all programs highlight the importance of building connections in communities as a way of building resilience to future risks posed by climate change.

4.3.3 Consolidating local resources: Overcoming volunteer capacity challenges was a recurrent theme in the workshop. A participant from Ecoburbia noted that they overcame challenges with capacity and volunteer burnout by creating a street coordinator system to distribute information to 350 more effectively. The system was developed after the program leaders delivered flyers for events by hand to all houses and they needed a more efficient system to deliver flyers on each street. After putting out a call to the community, 16 people volunteered, establishing the current street coordinator system which Ecoburbia, Australia described as:

"When we have a flyer, I get them copied, we put them on a table out the front of my house. Each of those people know how many they need, and then they distribute that flyer to the area. It's like a telephone tree in many ways."

The system has also increased the capacity to organize future events as within the current organizational structure *"using those street coordinators we have a meeting once a year [. . .] and someone volunteers to organize some sort of activity every month."*

5. Discussion and conclusion

We began this research by setting out the existing opportunities and challenges of neighbourhood scale climate action (see table 1). To build upon these challenges and opportunities-as well as to identify ways forward of overcoming these challenges- we have presented inputs from three neighbourhood scale climate action projects- two in Canada and one in Australia. In this section, we synthesize the findings from literature as well as our workshop participants to derive key recommendations for advancing neighbourhood scale climate action.

5.1 Scale: The opportunities of the neighbourhood scale in being tangible and recognisable for residents clashes against its challenges of shaping and sustaining climate action programs (Cloutier et al., 2018; Rohe, 2009). The workshop participants point toward utilising the existing scalar opportunities and utilising multi-scalar dynamics to overcome these challenges. Developing a collaborative governance model between the neighbourhood and city scale programs is a way forward in this regard. Here the city programs may benefit from the close knit structures of the neighbourhood scale and the neighbourhood programs can draw on the expertise and financial resources at the city scale to sustain their programs.

5.*2 Social structures:* Mutualism and social capital are described as the foundation of building climate action programs in a neighbourhood (Rowlands, 2011). However

neighbourhoods are not homogeneous entities and neither are neighbourhood-based associations, and thus disagreements may exist regarding climate change and climate action projects (Joshi, Agrawal and Welegedara, 2022). The workshop participants pointed towards the idea of incremental community building as a foundational strategy for a climate action program. Further, community building is also described as a positive co-benefit of bringing people together on climate action projects.

5.3 Bottom-up democracy: Scholarly literature recognises a mismatch between the expectations of bottom-up action on climate change and the power and resources available at the neighbourhood scale for realising it (Büchs et al., 2012; Lufkin and Rey, 2014). This was confirmed by the workshop participants who have worked with consolidation of available resources and expertise to start climate action programs. This is also closely linked to the themes of collaborative governance and incremental community building as ways of laying the foundation of climate action programs. In the absence of dedicated budgets and formally recognized institutional structure or incorporation within the city's climate governance structure, it is useful to begin with small-scaled actions that are not capital and labour intensive, but instead rely on individual and group leadership that can emerge from communities, who can come up with creative ideas that can require micro financing. An incremental approach can be useful in providing data that resemble pilot projects to the city and other larger institutions, who can consequently devise methods to scale up successful projects and actions.

Table 3 below summarises the key opportunities and challenges identified in literature as well as ways forward identified by workshop participants.

Table 3 Advancing neighbourhood climate action: opportunities, challenges and way forward

Opportunities	**Challenges**	**Way forward**
Optimal scale: physically and socially tangible for residents	Sub-optimal scale: small scale and short term action	Collaborative governance between the city and neighbourhoods
Mutualism and social capital: neighbourhoods have strong social networks	Social challenges: reproduction of socio-economic inequalities.	Incremental community building
Realizing bottom-up democracy: participate in decisions on climate change	Power and resources : largely concentrated at the city scale	Consolidating local resources

As we drew from the experience of three neighbourhood scale climate action programs located in different contexts. There were noticeable similarities and differences in approach and context. Across all three programs, the central approach appears to be similar – small activities, such as community movie nights or potlucks, are important building blocks for developing the community and a place-based attachment necessary for building community resilience. In creating a sense of community, by allowing people to know and care for each other, the aim of these programs is to teach people to learn to work together with the aim that they will act on this together when climate change or extreme weather events happen.

Participants pointed out that it is very important that all stakeholders recognize the historical and institutional context within which discussions and actions are carried out. Participants emphasized during the workshops that the Community Leagues "*need to look at their own history, on programs that have worked in the past"* which can help identify useful starting

points that can be leveraged for future actions and programs. Understanding context is useful in knowing how a particular neighbourhood and its institutional structure is unique, what decisions were made in the past, and which actors and actions played an important role in leading planning and environmental actions. This will help understand what specific actions and governance options might work in that context, thus avoiding a 'one-size-fits-all' approach that assumes that neighbourhood scaled actions can be uniform. Incorporating various local stories that describe past risks, events can aid in developing an understanding of the community perception and biases that might exist.

We adopted workshops as a co-creative research methodology. We found it a useful tool for understanding different experiences of neighbourhood climate action projects. However, we also acknowledge a positive bias in our research design towards neighbourhoods that have on-going programs on climate action. This might be because of a certain socio-economic status of these neighbourhoods that make it possible to run such programs. This limits us in contributing towards discussions on socio-economic variability in neighbourhood climate action. Future study designs can opt for neighbourhoods where such programs do not exist or have not been successful to contribute to a discussion on socio-economic challenges in neighbourhood climate action.

Neighbourhood climate action presents significant opportunities for planning and governance for local climate change effects. However, its small scale and limited impact often raise questions about its efficacy and sustainability. Drawing from the experience of three neighbourhood climate action programs we recommend collaborative governance, incremental community building and resource consolidation as the foundational steps to overcome some of the recurrent challenges of working at this scale.

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