Climate change adaptation in Metro Vancouver: The role of boundary organizations and advocacy planning

by

Alexandra J. Graham

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

This thesis follows the manuscript option for master students in the School of Planning at the University of Waterloo. This thesis consists of two separate manuscripts that have been submitted to refereed journals. I am the principal author in all chapters; however, Dr. Carrie Mitchell made contributions to both manuscripts.

The first manuscript, *Is Advocacy a Dirty Word? Planning for Climate Change Adaptation in Canada,* is co-authored with Dr. Carrie Mitchell. Mitchell contributed 10% in idea feedback, structure improvement, and editing throughout. This manuscript is ready for submission to the *Journal and Planning Education and Research*.

The second manuscript, *The Role of Boundary Organizations: Effective Partnerships to Foster Urban Climate Change Adaptation*, is also co-authored with Dr. Carrie Mitchell. Mitchell contributed 15% in idea development, research questions feedback, structure improvement, and editing throughout. This manuscript was submitted for publication with *Climatic Change.*

Abstract

City planners have an opportunity to act as agents of change to build resilience within their cities to respond to climate change. With climate change rapidly changing urban environments, it is critical that municipal planners are advocating for adaptation based on the latest science. Advocacy planning was proposed in the mid-twentieth century as an alternative to the rational comprehensive planning model. However, in the current era, the rational comprehensive model still dominates planning environments and climate change adaptation guides. Using a case study in Metro Vancouver, I interviewed municipal practitioners about their experience planning for climate change adaptation. Results demonstrate that municipal practitioners can have conflicting views regarding their responsibility to advocate for climate change adaptation planning. Practitioners feel responsible for the health and safety of their constituents, but also feel responsible to act on behalf of the views of their constituents and council. This thesis explores this tension and proposes strategies for urban planners to position themselves as advocates for climate change adaptation planning.

Additionally, this thesis builds on urban climate governance research to focus on how city planners' partnerships with boundary organizations influence adaptation planning within cities. At the root of effective urban climate governance is the integration of science and policy. Boundary organizations offer a governance approach that disseminates knowledge, builds capacity, and engages more participants in the adaptation planning process. However, little is known about how these partnerships foster adaptation at the local scale. Using a case study in Metro Vancouver, this study investigated how boundary organizations can better support municipal adaptation action. This case study builds on existing theory on local adaptation

planning by incorporating concepts from organizational change theory. The results of this study demonstrated that boundary organizations were perceived as more influential when they were *credible*, *legitimate*, and *salient,* as well as when they provided *action-oriented support*. Ultimately, this paper contributes to the literature by illustrating how boundary organizations operate at the sub-regional scale to foster adaptation and proposing tangible administrative practices to improve the effectiveness of these partnerships.

Acknowledgements

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Finally, I would like to thank all of the participants who took time to speak with me about their experiences and who had general interest in improving how our cities prepare for climate change impacts.

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Chapter 1: Introduction

The World Economic Forum (2016) considers failure to mitigate and adapt to climate change to be the most impactful global threat – higher than weapons of mass destruction, involuntary migration, and water crises. Urban environments are uniquely vulnerable to climate impacts because of their population density, built form, socio-economic demographics, and often close proximity to rivers and coasts. With the risk of both rapid and gradual climate impacts increasing, it is clear that conventional approaches to urban planning will be insufficient to adapt to climate change. This research investigates two critical strategies municipal practitioners have to advance adaptation: advocacy planning and boundary organizations.

Human activities have generated carbon dioxide, methane, and nitrous oxide at levels unprecedented in the last 800 000 years, and these emissions continue to increase largely unabated (Intergovernmental Panel on Climate Change [IPCC], 2014) (Figure 1.1). As a result, these greenhouse gas emissions have contributed to warming atmosphere and oceans, melting glaciers, and sea level rise. These changes stress human, biological, and physical systems unevenly (Figure 1.2). With increased extreme high temperature days, increased extreme precipitation, and rising sea levels, many cities will be exposed to more severe challenges including heat waves, disease breakout, flooding, infrastructure damage, wildfires, droughts, and food shortages (IPCC, 2014).

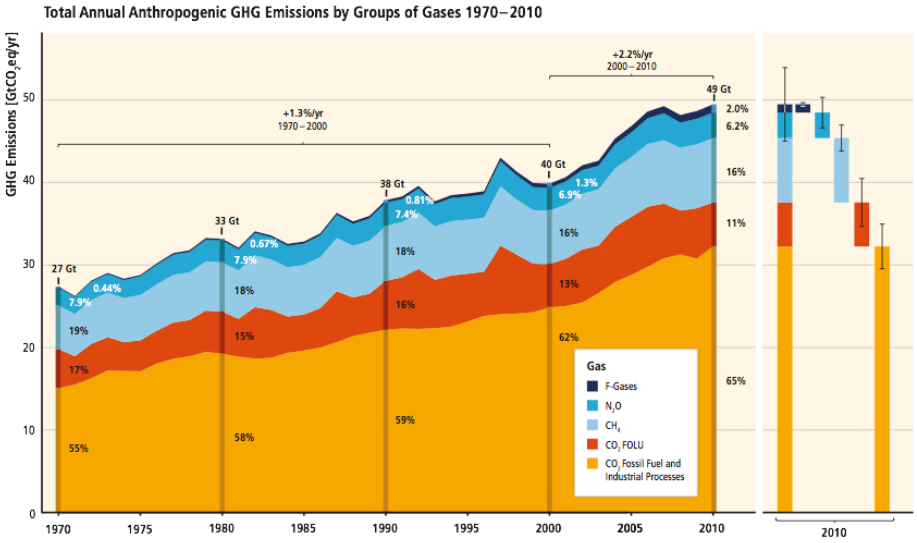

Figure 1.1 Annual Anthropogenic GHG Emissions by Groups of Gases 1970-2010 (IPCC, 2014)

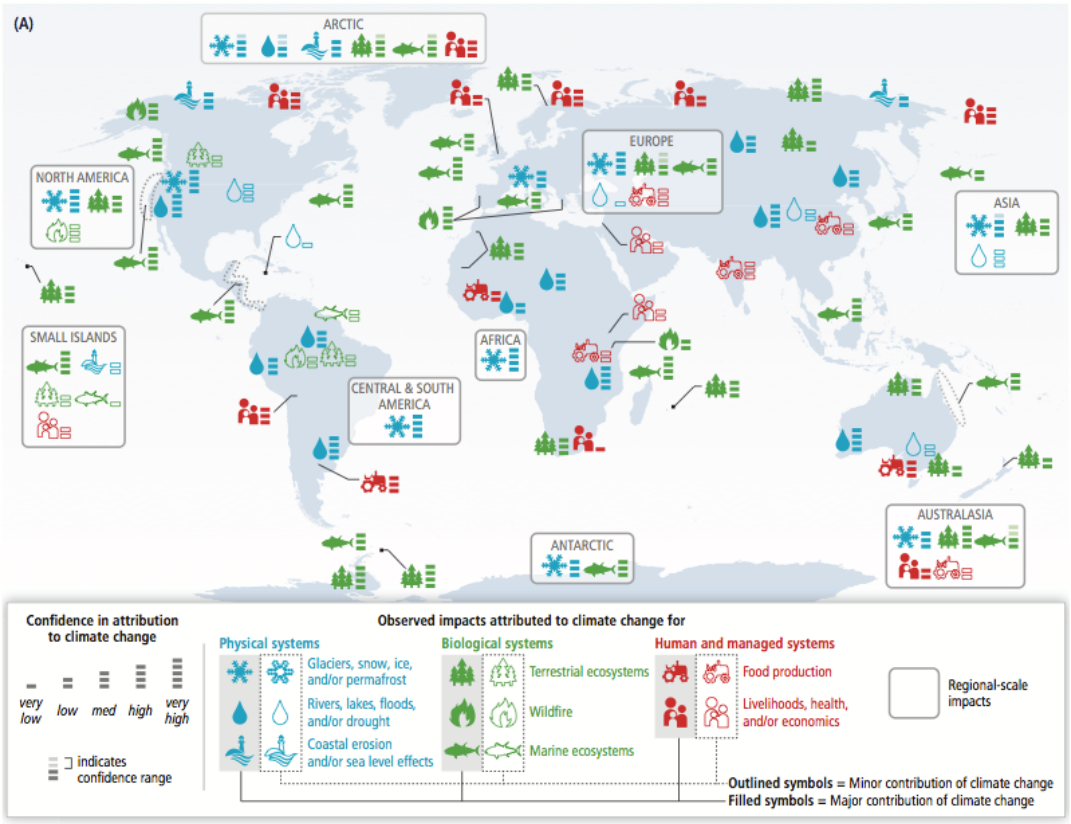

Figure 1.2 Widespread Impacts of Climate Change (IPCC, 2014)

The world is also becoming increasingly urban, with 54% of the world's population living in urban environments (United Nations, 2014). By 2050, the United Nations (2014) projects that 2.5 billion more people will be living in urban areas due to urbanization and population growth. Cities are uniquely vulnerable to climate change impacts due to their physical characteristics and socio-economic structures. For historic reasons, most cities are located near rivers, floodplains, or the coasts (Turnbull et al., 2013). The risks of flooding are further exacerbated due to poor urban planning and ineffective natural resources management. The built form also increases temperatures and concentrations of air pollutants due to the urban heat island effect (Dreyfus, 2013).

Cities' underlying socio-economic structures also increase disaster vulnerability (United Nations Environmental Programme, 2007). Urban areas have high population densities, poverty, and pollution, and they have a large concentration of economic and cultural activities (Carter et al., 2015). Cities are brittle systems. If one of their complex inter-dependent services failed (such as electricity or water), cascading failure could push the city into a non-functioning state (Graham, 2009). Often urban residents are completely reliant on the municipality for critical needs, such as access to water, electricity, and transportation infrastructure (Baker 2012; Rosenzweig et al., 2010; Turnbull et al., 2013). These, brittle systems could lead to catastrophe in the event of a disaster.

However, cities also have unique adaptive capacities to address their vulnerability to climate change and climate disasters. Adaptive capacity refers to a system's ability to respond successfully to climate change (IPCC, 2007). Cities benefit from human capital to plan and implement adaptation measures, diverse livelihoods that spread risk, and economies of scale where expensive measures can be justified to protect large populations and economic activities

(Turnbull et al., 2013). Additionally, cities operate within a multi-layered and interconnected governance system (Dreyfus, 2013). While poor governance hinders adaptive capacity, good governance is critical to plan for climate change adaptation and disaster risk reduction.

Climate change adaptation is governed by a complex group of public, private, and civic actors that operate at various scales. Local actors – particularly municipal governments – are emerging as leaders in adaptation due to the local nature of climate impacts and, in some contexts, the lack of national direction (Rosenzweig et al. 2010). Within municipal governments, urban planners can play a critical role in planning for adaptation because they can foster negotiation among stakeholders, coordinate capacity, facilitate implementation, and serve as a point of consistency in the adaptation planning process (Hanna et al., 2014).

While cities have incentive to adapt, many cities have not yet started preparing for climate change adaptation. In Canada, it is estimated that approximately 45% of Canadian communities have no adaptation plans and are not planning on creating one soon (Hanna et al. 2014). Barriers to adaptation include the unavailability of local climate change projections, limited funds, lack of vertical collaboration (Moser & Ekstrom, 2010), as well as regulatory limits, institutional inertia, or internal staff behavioural/cultural challenges (Burch 2010), and the science-policy disconnect (Tribbia & Moser, 2008). This thesis explores two key challenges municipal practitioners face with planning for climate change adaptation: institutional/cultural challenges and the science-policy disconnect. A case study was conducted in Metro Vancouver to investigate how advocacy planning and boundary organizations address these barriers to better support municipal adaptation planning.

1.1 Research Objectives and Questions

1.1.1 Manuscript 1: Is Advocacy a Dirty Word? Planning for Climate Change Adaptation in Canada

Municipal governments are critical to climate change adaptation (Betsill & Bulkeley, 2006; Carter et al., 2015; Castán Broto & Bulkeley, 2013; Rosenzweig et al., 2010). However, conventional urban planning methods are inadequate to respond to the changing climate (Jabareen, 2013). Rational comprehensive planning methods still dominate planning practice (Hodge & Gordon, 2014), which encourage planners to present objective, value-neutral information to key stakeholders. However, advocacy planning theory recognizes that information can never be value-neutral and apolitical; therefore, the role of the urban planner should be to advocate for action on behalf of the public interest (Davidoff, 1965). At such a critical time in human history, urban planners are well positioned to advocate for long term planning that incorporates climate change adaptation to protect current and future public interest (Hanna et al., 2014). Therefore, it is imperative to understand if – and in what ways – municipal staff consider themselves to be responsible and/or advocates for climate change adaptation.

The purpose of Manuscript 1 was to understand the role of advocacy planning in municipal climate change adaptation. This study addressed three main research questions:

1. How do municipal practitioners feel responsible for climate change adaptation?
2. Do municipal practitioners feel that they should incorporate advocacy planning?
3. How can municipal practitioners be better supported to be advocates?

1.1.2 Linking Manuscript 1 and 2

Manuscript 1 focused on how municipal practitioners could better be supported to advocate for municipal climate change adaptation. Municipal practitioners stated that having access to local, climate data projections and adaptation options would help them advocate for more adaptation action and resources. Interviewees acknowledged that boundary organizations were an important tool to connect city staff to adaptation resources. The interviews further explored the concept of boundary organizations to analyze municipalities' current relationships with boundary organizations. This led into the Manuscript 2, which investigated the role of boundary organizations in climate change adaptation and analyzed practical strategies boundary organizations could incorporate to better support adaptation action within municipalities.

1.1.3 Manuscript 2: The Role of Boundary Organizations: Effective Partnerships to Foster Urban Climate Change Adaptation

The science-policy disconnect is a critical barrier to many adaptation planning decisions, whereby policy decisions are made without incorporating recent, robust climate and adaptation science (Tribbia & Moser, 2008). Boundary organizations have been proposed as an effective tool to address the science-policy disconnect and support municipal adaptation practitioners plan for climate change adaptation (Bauer & Steurer, 2013; Corfee-Morlot et al., 2011; Hoppe and Wesselink 2014; Lemos et al., 2014; Tribbia & Moser, 2008). However, many partnerships have failed to impact adaptation planning at the local scale (Harman, Taylor, & Lane, 2014). Additionally, Parker and Crona (2012: 263) stated that "little is known about how to create successful boundary organizations, how they relate to their constituents, and the most effective boundary management approaches and on-the-ground administrative strategies."

The objective of this empirical study was to address this gap in the literature to determine how boundary organizations can better support municipal adaptation from the municipal practitioners' perspective. Two key research questions were as follows:

1. How do boundary organizations operate at the local level to support municipal adaptation planning?
2. What practical strategies should boundary organizations incorporate to better support municipal adaptation planning?

1.2 Organization of Thesis

This thesis follows the manuscript option for master students in the School of Planning at the University of Waterloo. This thesis includes two independent manuscripts and together they explore the role of advocacy planning and boundary organizations in municipal climate change adaptation. The first manuscript (Chapter 2), *Is Advocacy a Dirty Word? Planning for Climate Change Adaptation in Canada,* is ready for submission to the *Journal and Planning Education and Research*. The second manuscript (Chapter 3), *The Role of Boundary Organizations: Effective Partnerships to Foster Urban Climate Change Adaptation,* has been submitted to *Climatic Change* and is in the process of revised review. Both are formatted based on journal requirements. Chapter 4 summarizes key findings from the two manuscripts and proposes directions for future research.

Chapter 2: Is Advocacy a Dirty Word?
Planning for Climate Change Adaptation in Canada

2.1 Introduction

When scientists speak out against evidence, this is often considered a "display of bias" and "unprofessional and unscientific" (Hancock, 2015, p. 87). Trevor Hancock, Senior Editor for the Canadian Journal of Public Health, recently (2015) criticized public health professionals and academics in an editorial on the lack of advocacy in public health. He argued that public health professionals have a responsibility to advocate for the public interest; it is one of their core competencies. However, the perception that advocacy displays a lack of objectivity – as well as Canada's recent "war on science" – has led to unethical self-censorship among many public health practitioners and academics (p. 87). Our paper explores whether the same can be said about urban planners and climate change adaptation in Canada.

At the root of urban planning is the concept of the public interest. The Canadian Institute of Planners' Code of Conduct requires planners to respect the "diversity, needs, values and aspirations of the public" (2014). In the past century, planning theories have evolved from traditional technocratic models that aim for objectivity, such as the rational comprehensive model, to less traditional models, such as advocacy and communication planning, that focus on providing a voice to the less vocal, more disadvantaged public. Planning models today recognize the importance of social justice, public participation, and sustainability, and many tools have emerged to facilitate participatory action research in cities (Chevalier & Buckles, 2013; Mackenzie et al., 2012). However, the rational comprehensive model still dominates current planning practice (Hodge & Gordon, 2014).

As climate change accelerates, our urban environments continue to face dangerous

changes in temperature, precipitation, sea level rise, and extreme events. Conventional approaches to urban planning will be insufficient to adapt to climate change (Jabareen, 2013). At such a critical time in human history, urban planners are well positioned to advocate for long term planning that incorporates climate change adaptation to protect current and future public interests (Hanna et al., 2014). However, are there limits to what planners believe they can do?

This paper investigates whether and how municipal practitioners feel responsible for planning for climate change adaptation in Metro Vancouver. These findings are particularly relevant for current planners to encourage them to be more self-reflective practitioners (Schon, 1983) as well as planning educators to better equip future planners with the tools and courage to incorporate advocacy planning in their future practice. First, we provide a literature review on climate change adaptation theory and provide a brief history of dominant urban planning theories. Next, this paper demonstrates the conflicting roles municipal practitioners have in Metro Vancouver when incorporating climate change adaptation into their planning process. We outline why municipal practitioners are well positioned to advocate for climate change adaptation and highlight how they can be better supported by key networks, including boundary organizations, higher levels of government, universities and colleges, and industry associations.

2.1.1 Climate Change Adaptation

Failure to mitigate and adapt to climate change is considered to be the most impactful global threat – higher than weapons of mass destruction, involuntary migration, and water crises (The World Economic Forum, 2016). Mitigation refers to a "human intervention to reduce the sources or enhance the sinks of greenhouse gases" (IPCC, 2012, p. 561). Adaptation is defined as "adjustment in natural or human systems in response to actual or expected climatic stimuli or

their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2014, p. 5). Adaptation can be *anticipatory*, by operating before observed impacts; *autonomous*, by operating in response to observed stimulus; or *planned*, by establishing a deliberate policy decision (IPCC, 2007). However, the definition of adaptation leaves ambiguity to *who* should be adapting, *how* they should adapt, over what *timeframe*, and *who* is responsible?

Smit et al. (2000) state that those who adapt can be "people, social and economic sectors and activities, managed or unmanaged natural or ecological systems, or practices, processes or structures of systems" (p. 228). The IPCC (2014) states that certain people are especially vulnerable to climate change, including people who are marginalized economically, socially, politically, institutionally or culturally. Therefore, adaptation can take place at the individual, household, regional, or global levels.

Biagini et al. (2014) created a typology of adaptation based on a categorization of projects funded by the Global Environment Facility Adaptation Fund (Figure 2.1). They found that common adaptation approaches included enabling and inexpensive measures, such as capacity building and policy reform, as well as technical actions, such as new infrastructure and early warning systems. However, categorizing and monitoring adaptation options is inherently complex because many actors may be adjusting their systems to climate change but not identifying these actions as adaptation. Without clear criteria of successful adaptation and widespread understanding of adaptation terminology, uncertainties remain around how it should be prioritized, funded, and evaluated. With adaptation projects underway worldwide, many agencies have begun developing online compendiums of adaptation options, such as weADAPT, Climate Adaptation Knowledge Exchange Empirical, and European Climate Adaptation Platform. However, research is required to determine how cities are actually adapting with the

absence of clear adaptation options that have been objectively verified as successful (Mitchell, Burch, & Driscoll, 2016).

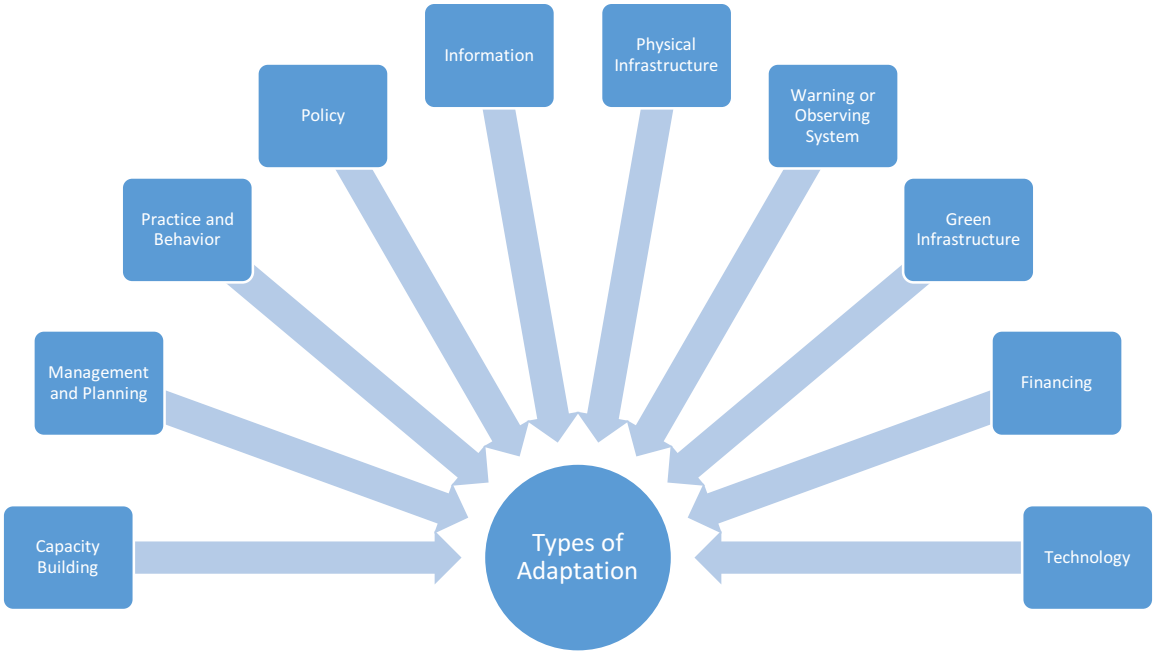

Figure 2.1 Typology of Adaptation Activities (Adapted from Biagini et al., 2014)

Adaptation options moderate harm by addressing system vulnerabilities. However, there is inherent uncertainty in the definition of vulnerability. Vulnerability is defined by the IPCC (2014) as "the propensity or predisposition to be adversely affected" (p. 5). A clear definition of vulnerability is critical as it has implications for how adaptation is approached and which countries receive funding (O'Brien et al., 2004). O'Brien et al. (2004) demonstrate that vulnerability can either be thought of as a starting point or an end point. Nielsen and D'Haen (2014) explain that this still represents a key divide within climate change research.

Nielsen and D'Haen (2014) state that physical scientists tend to favour an end-state interpretation of vulnerability and attempt to project emissions and quantify the residual vulnerability (Dunford et al., 2014; Schröter et al., 2005), while social scientists tend to favour a

starting-point interpretation and argue that adaptation needs to address the present inabilities to cope (Hopkins, 2014). O'Brien at al. (2004) suggest that we could split the definitions and have two definitions to improve clarity: net impacts (end-point) and vulnerability (starting-point). Smit and Wandal (2006) state that most importantly we need a definition and *model* that has the practical effect in reducing vulnerability. For the purpose of this research, vulnerability is considered to be a pre-existing condition that is unevenly spread across individuals, groups, and communities (Joakim, Mortsch, & Oulahen, 2015) (Figure 2.2).

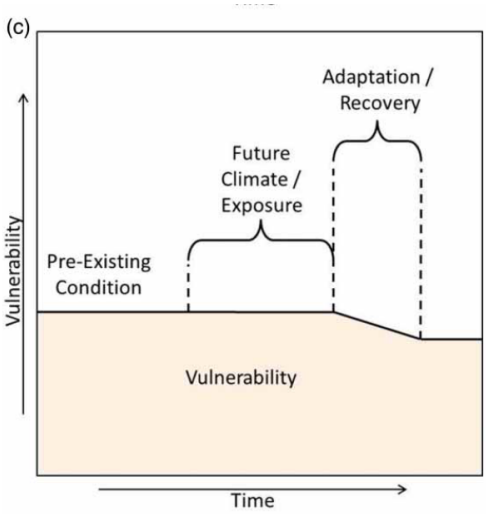

Figure 2.2 Vulnerability as a pre-existing condition that is reduced during adaption/recovery (Joakim, Mortsch, & Oulahen, 2015)

2.1.2 Urban Planning Theory

Contemporary approaches to urban planning are inadequate to reduce climatic vulnerabilities because of the complexities, uncertainties, and long timescale associated with climate change (Hamin & Gurran, 2009; Jabareen, 2013). Today's planners must re-evaluate their role within the adaptation planning process. Municipal planning is extremely important for

adaptation, as it is forward-thinking and centralized within local governments (Archer et al., 2014). Different local adaptation planning processes have been developed and promoted by international organizations, consulting firms, and local municipalities (Carmin, Nadkarni, & Rhie, 2012). Planning processes can facilitate the creation of a central adaptation plan, mainstream adaptation planning into current plans and projects, or achieve both.

However, current urban planning theory does not adequately address how urban planners can advocate for climate change adaptation, especially when a municipality's political environment is not receptive to change. Current planning models lack strategies to navigate the political and power contexts of planning (Forester, 2008). To better understand how planners can more effectively collaborate with politicians and advocate for climate change adaptation, it is useful to review how planning theory has developed and reassess Davidoff's (1965) advocacy planning model.

In the 1950s, the rational comprehensive planning model evolved from the positivism movement, which seeks to incorporate scientific reasoning into the planning process. Planners' advice was assumed to be apolitical and the final definition of the unitary public interest was assumed to be in the hands of the elected officials (Howe, 1992). In the rational comprehensive model, it was assumed that planners would first consider all alternatives, then evaluate each option, and finally select an option that is most aligned with community objectives (Hodge & Gordon, 2014). While this model has been improved, its core elements have remained central to modern planning practices and similar models are still followed today (for example Figure 2.3) (Berke et al., 2006; Schonwandt, 2008; Yigitcanlar & Teriman, 2015). The rational comprehensive model formed the basis for modern urban planning and today's Master Planning and Comprehensive Planning (Schonwandt, 2008). Master and Comprehensive plans are present

in most Canadian cities. For example, the City of Toronto has several master plans, including the PATH Pedestrian Network Master Plan, which followed four key stages: (1) research and analysis, (2) community engagement and visioning, (3) plan developing and evaluation, and (4) implementation (City of Toronto, 2012). In relation to adaptation planning specifically, the City of Windsor, Ontario and the Town of Yarmouth, Nova Scotia developed their Climate Change Adaptation Plans using an initiate, research, plan, implement, and monitor process (Government of Canada, 2012).

Figure 2.3 General Model of the Community Plan-Making Process (adapted from Hodge & Gordon, 2014)

The 1950s' rational comprehensive model was heavily criticized for assuming (1) there was *one* public interest and (2) that the planning process was apolitical, and planners could

objectively determine the best-end state (Lane, 2005). In the 1960s, planning theorists began to recognize the plurality of public interests and the value of public participation. Alongside the feminist and civil rights movements, Jacobs (1961), Davidoff (1965), and Arnstein (1969) articulated that public participation was the cornerstone of democracy and, therefore, planning.

Public participation theory can be seen influencing planning legislature in Britain, Canada, and America in this era. The Bureau of Municipal Research (1974) in Canada stated that participation was "a component of the democratic system which permits non-elected members of the community to exercise some control over decision-making which goes beyond elections" (as cited in Shipley & Utz, 2012). By 1983, planning legislation had formalized consultation practice and led planners to engage the public with techniques beyond public meetings and open houses, such as focus groups and workshops (Shipley & Utz, 2012). Public participation was considered essential for a successful project. In 1978, Prime Minister Pierre Trudeau stated "the only choice facing governments at all levels is whether to invite such participation at every stage of the decision-making process, in an atmosphere of co-operation, or whether to encounter participation after the fact, in an atmosphere of hostility. It is really no choice at all" (as cited in Chapin & Deneau, 1978). Since the 1990s, scholars have continued to advocate for the public interest through communicative planning (Habermas, 1987), collaborative planning (Innes & Booher, 2004), and consensus planning (Forester, 2008).

The 1950s' rational comprehensive model was also criticized because it assumed that planners, and planning decisions, were apolitical in nature. Rational behaviouralist traditions' criticisms were not limited to planning. For instance, political science theorists March and Olson (1984) argued that individuals and organizations did not make decisions based on a rational assessment of costs and benefits, but instead made decisions based on institutional norms and

values; this formed the basis for the political theory 'new institutionalism'. However, political thoery did not influence planning practice in the same way that the recognition of the plurality of interests did. Davidoff (1965) addressed both criticisms in his influential piece, 'Advocacy and Pluralism in Planning'. His arguments regarding pluralism and public participation spoke to the *process* of planning, while his advocacy arguments spoke to the *role* performed by the municipal practitioner.

Advocacy planning acknowledged the plurality of interests and the responsibility of the planner to advocate for the unprivileged and underrepresented (Lane, 2005). Davidoff (1965) rejected the idea that planners' role was to provide objective research to decision makers, where any values were made explicit. Instead of explicating values, Davidoff said the planner "should affirm them; he should be an advocate for what he deems proper" (p. 331). He believed that "the planner as advocate would plead for his own and his client's view of the good society. The advocate planner would be more than a provider of information, an analyst of current trends, a simulator of future conditions, and a detailer of means. In addition to carrying out these necessary parts of planning, he would be a *proponent* of specific substantive solutions" (p. 333).

Building on Davidoff's advocacy planning, other urban planning theorists have expanded on the inherent tension between being both an advocate for the public interest and also a subservient employee of elected officials. Lash (1976) recognized that effective community planning was only possible when the planner, public, and politician are able to cooperate. Forester (1989) expressed concern over the political nature of planning, whereby planners are accountable to both the public and politicians. This tension became the basis for consensus planning (Forester, 2008).

However, current planning practice and legislation do not adequately address how planners should effectively navigate the political context of planning (Hodge & Gordon, 2014, p. 363). While many tools have been developed to support public participation, few tools exist to help planners work effectively with politicians. Planners and politicians are highly interdependent; politicians rely on planners for technical advice and planners rely on politicians to support their plans. Planners have the challenging task of trying to be impartial to political influence, while acting on behalf of the public, and simultaneously not jeopardizing their careers by being at odds with politicians. Planning models do not explicitly address how to balance competing interests. Hodge and Gordon (2014) state that planners are expected to learn how to act strategically through training and practice; however, they also state that training rarely equips planners for political leadership, and there are few formal specifications that guide action.

In the 21st century, planning practices still largely reflect rational comprehensive planning, albeit with more opportunities for public engagement (Berke et al., 2006; Lawrence, 2000; Schonwandt 2008; Yigitcanlar & Teriman, 2015). However, this planning process is insufficient to motivate transformational climate action. Political actors and public constituents do not always prioritize climate change (Burch, 2010). Barriers to climate change prioritization include the perceived timescale of climate impacts, the unavailability of local climate change projections, limited funds, lack of vertical collaboration (Moser & Ekstrom 2010), as well as regulatory limits, institutional inertia, or internal staff behavioural challenges (Burch, 2010). Urban planners are well positioned to advocate for climate change adaptation but are often dependent on public opinion and political interests. Davidoff viewed advocacy planning as complementary, and essential, to the rational comprehensive model to better articulate and evaluate alternatives (Faludi, 1987). The same is true today. Therefore, it is critical to re-evaluate

the role of advocacy planning and ensure planners feel confident in their role to advocate for climate change adaptation.

2.1.3 Adaptation and Urban Planning

While Canada does have some examples of municipal adaptation planning (i.e. Vancouver, Toronto, Quebec City, Halifax, Regina), many Canadian cities have not yet started planning for adaptation (Hanna et al. 2014). Many adaptation planning models that exist to support planning resemble the rational comprehensive mode, such as *Adapting to Climate Change: An Introduction for Canadian Municipalities* (Government of Canada, 2010); *An Climate Change Adaptation Planning: A Handbook from Small Canadian Communities* (Bowron & Davidson, 2011); *Changing Climate, Changing Communities* (ICLEI Canada, 2010), *Land Use Planning Tools for Local Adaptation to Climate Change* (Government of Canada, 2012); *Implementation Framework for Climate Change Adaptation Planning at a Watershed Scale* (Canadian Council of Ministers of the Environment, 2015); *Municipal Climate Change Action Plan Guidebook* (Canada - Nova Scotia Infrastructure Secretariat, 2011); and *Canadian Communities' Guidebook for Adaptation to Climate Change* (Bizikova, Neale, & Burton, 2008). Common steps among these Canadian adaptation guides include project initiation, research, planning, implementation, and monitoring. Only two of these plans (ICLEI Canada, 2010; Canada – Nova Scotia Secretariat) explicitly state advocacy as a tool to complement the planning process, and in both cases the brief mention of advocacy refers to engagement of external partners (i.e. community organizations and business) and not internal partners (i.e. urban planners advocating councillors and senior staff).

Canadian adaptation guides are similar to most adaptation planning models, which function in a "predict and prevent" manner instead of planning for uncertainty and resilience (Wise et al., 2014) and incorporating advocacy. Preston, Westaway, and Yuen (2011) reviewed 20 influential adaptation planning guides to define common criteria for robust adaptation planning. They used a Logical Framework Analysis to determine four common stages of adaptation planning: (1) goal setting, (2) stock-taking, (3) decision-making, and (4) implementation and evaluation.

An example of a progressive adaptation planning guide that resembles the rational comprehensive model is ICLEI Canada's municipal adaptation guide (Figure 2.4). While ICLEI Canada does encourage planners to find internal adaptation champions and include public participation in the process, their guide does not clarify how practitioners can advocate internally for climate adaptation in the absence of support from elected officials. It is difficult to only use the rational comprehensive model to plan for adaptation because if climate adaptation planning is not a council priority, due to its political nature and the unavailability of downscaled climate data, then climate adaptation will be thwarted. Urban planners should be prepared to advocate for adaptation despite limited council support.

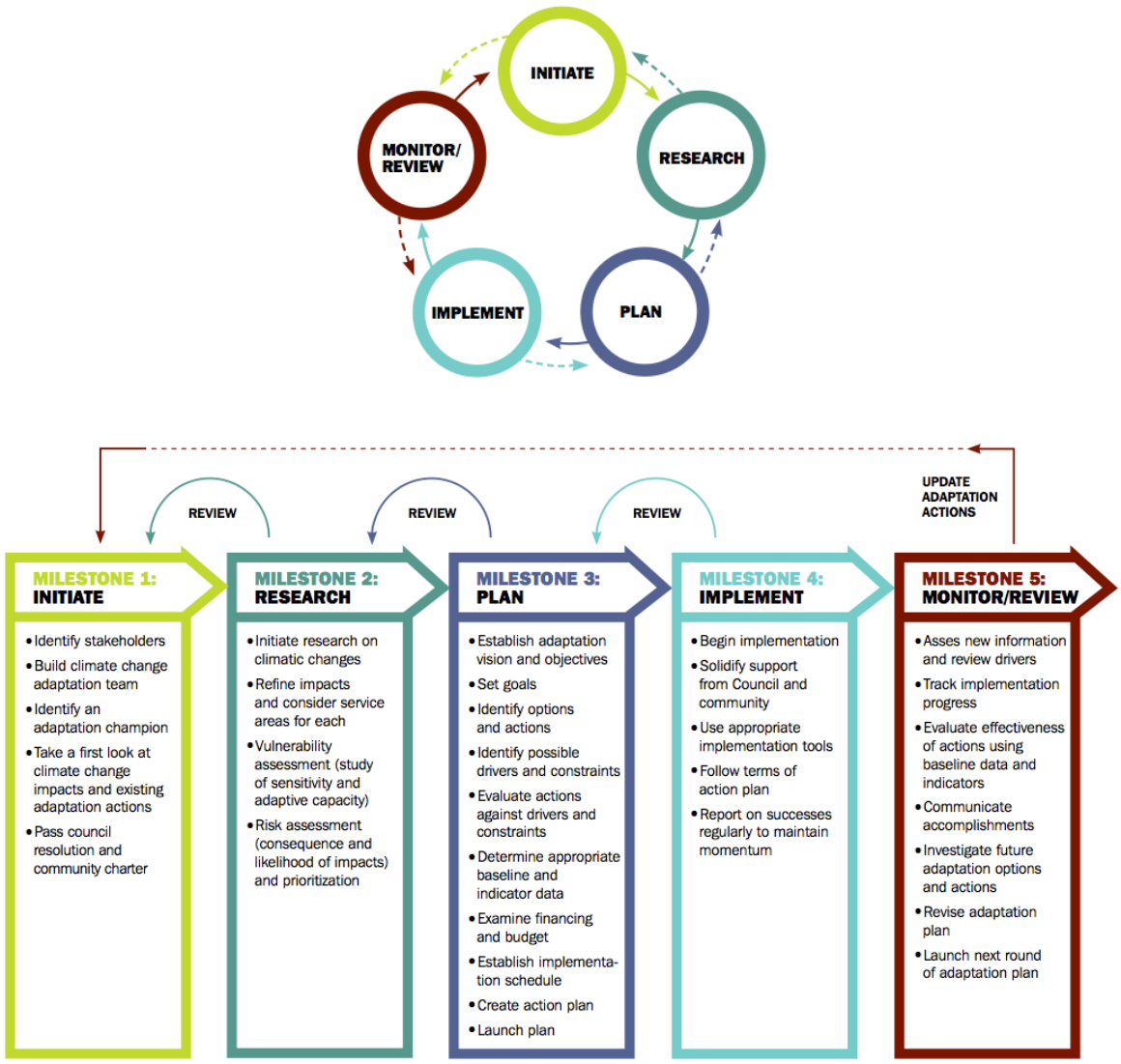

Figure 2.4 ICLEI's Milestone Framework for Municipal Adaptation Planning (ICLEI, n.d.)

Hanna et al. (2014) surveyed 481 communities across Canada to gauge adaptation planning efforts in Canada. Their results indicated that while 75% of responding communities had experienced extreme climatic events in the last 10 years, a significant portion of Canadian cities (45%) do not have an adaptation plan and were not considering adaptation planning. Only 5% of surveyed cities had adaptation plans and only 8% had mainstreamed adaptation into other municipal plans. Adaptation planning was only delegated to the planning department in 16% of

municipalities. Hanna et al. (2014) determined that the main enablers of adaptation planning were political and planning leadership, as well as support from the provincial government. They stated that planners are well positioned to advance adaptation planning because they can foster negotiation among stakeholders, coordinate capacity, facilitate implementation, and serve as a point of consistency in the adaptation planning process. While political interest may shift, planners can support policies that transcend the political process.

The Canadian Institute of Planners (CIP) (n.d.) published that planners should be leaders in climate change adaptation planning:

> Planning for climate change is an essential part of ethical and responsible planning practice. Planners are well suited to this challenge. Our profession has long been concerned with balancing present needs and future requirements to ensure the long term prosperity of our communities. Planning rarely occurs in circumstances of perfect information and planners are accustomed to developing adaptable and flexible responses to deal with uncertainty. For these reasons, planners must play a leadership role in enabling a climate-neutral society and preparing our communities for climate change impacts (p. 5).

CIP recognizes that climate action is often a result of strong, political leadership. Without a political champion, CIP states that it is "then imperative for planners to make a convincing case for action and establish links to other priorities as they try to influence decision-makers" (p. 24). City planners and practitioners have a responsibility to advocate for climate change adaptation planning. However, in practice planners must also navigate public and political interests. While planning literature and the professional association CIP both position planners as central to

climate change adaptation, the question remains whether planners in practice consider themselves to be responsible for climate change adaptation and advocacy.

2.3 Metro Vancouver Case Study

Metro Vancouver was chosen as a case study to analyze municipal practitioners' perceived roles in planning for climate change adaptation. This region was chosen due to the potentially significant immediate and gradual impacts of climate change, its urban form, and the current adaptation progress provincially and municipally. Metro Vancouver is located in British Columbia on the west coast of Canada. It has a population of 2,400,000 people spread over 21 municipalities, one Electoral Area, and one Treaty First Nation (Statistics Canada, 2012). The City of Vancouver is the region's largest municipality with a population of 600,000 people, and the City is one of the most densely populated municipalities in Canada (Statistics Canada, 2014).

Climate change is projected to impact Metro Vancouver in both gradual and abrupt ways. The region is projected to have increased winter precipitation and flooding, sea level rise, and higher annual temperatures (Pacific Climate Impacts Consortium, 2012). Metro Vancouver is located within the Fraser River Basin and it already drains approximately one quarter of British Columbia's water. Current risks of flooding are due to extreme rainfall and storm surges but flooding is exacerbated by snowmelt, dam-break flows, and drainage challenge due to urban form (Owrangi, Lannigan, & Simonovic, 2014). Richmond and Delta are at the greatest risk for flooding out of all the municipalities in Metro Vancouver (Barron et al., 2012). It is projected that by 2050, all areas within Metro Vancouver will have significantly more health risks due to increasing flooding from precipitation, snow melt, sea level rise, as well as socio-economic factors such as increased population density and aging populations (Owrangi et al., 2015).

In additional to the vulnerable populations, significant infrastructure is at risk including

Vancouver's International Airport, sewer systems, waste treatment facilities, highways, and over USD $55 billion of port assets (Nicholls et al., 2008). The Province of British Columbia stated that Metro Vancouver should be planning for a one-meter sea level rise by 2100; however, associated dike improvements are projected to cost CAD $9.5 billion (Ministry of Forests, Lands, and Natural Resource Operations, 2012). Without adaptation, a one-meter sea level rise in Metro Vancouver is projected to inundate 15,000 hectares of residential and industrial urban areas (Yin, 2001). Metro Vancouver has significant incentive to plan for adaptation for long-term impacts.

Climate change is also expected to impact Metro Vancouver through abrupt events and hazards, which the region has experienced in recent years. Abrupt impacts include increased extreme events, such as storm surges, flooding, landslides, extreme precipitation and wind, and extreme heat. In November 2006, the region experienced an intense rain event, which resulted in power loss to over 200,000 people, 150 home evacuations, seven closed highways, and a boil water advisory for two million people (Environment Canada 2013a). By 2050, it is projected that Metro Vancouver will experience extreme heat events three times as often as present events (Pacific Climate Impacts Consortium, 2012). In 2009, a deadly heatwave, with extreme daytime and nighttime temperatures, resulted in the death of 110 residents in Metro Vancouver (Environment Canada 2013b; Kasatsky, Henderson, & Pollock, 2012). The risk of mortality was geographically uneven across Metro Vancouver due to population density, age groups, and temperature hot spots (Kasatsky, Henderson, & Pollock, 2012).

The Province of British Columbia has become a leader in climate change adaptation in Canada. In 2010, the Province published an Adaptation Strategy to translate knowledge to key decision makers, coordinate strategic goals within government programs, and raise awareness

among stakeholders (Government of British Columbia, n.d.). The three core goals of their adaptation strategy related to (1) building a strong foundation of knowledge and tools; (2) mainstreaming adaptation with the Government; and (3) assessing risk and implementing actions in climate sensitive areas (Ministry of Environment, 2010). Many local communities within British Columbia have demonstrated climate leadership (Shaw et al., 2014). Approximately 70% of BC municipalities are addressing adaptation in some form (Hanna et al., 2014). Within Metro Vancouver, five municipalities have published adaptation strategies or resources online: The Corporation of Delta, The City of North Vancouver, The District of North Vancouver, The City of Surrey, and The City of Vancouver. All of these cities have participated in ICLEI Canada's *Building Adaptive and Resilience Communities* (BARC) program.

Burch (2010) identified strong leadership as a critical enabling factor for climate action in three British Columbian municipalities: The Corporation of Delta, The District of North Vancouver, and The City Vancouver. She interviewed municipal staff engaged in climate change mitigation or adaptation work to determine how barriers to climate action could be transformed into enabling factors. Some interviewees suggested that cultural/behavioural barriers could be overcome with strong, informed leadership, a shift towards a longer-term perspective, and the hiring of climate champion personalities. Interviewees in all three case studies felt that leadership was essential to outline explicit policy directives that prioritized climate change mitigation and adaptation. This explicit prioritization gave staff "*permission* to be innovative with regard to climate change" (p. 293; italics added). Without explicit policy, current enthusiasm for climate action could easily change with council elections. Our research builds on previous research in Metro Vancouver to better understand the dynamics of municipal adaptation – specifically how planners feel responsible for pushing the climate change adaptation agenda forward.

2.4 Methodology

My research methods consisted of qualitative interviews with planners and municipal practitioners that were actively involved in adaptation planning in Metro Vancouver. The interviewees shared their views and validated findings from academic and grey literature. Participants were purposely selected (Creswell, 2014) based on two criteria: (1) involvement in adaptation planning processes and (2) employment, or previous employment, at a municipality in Metro Vancouver. We identified 22 municipal practitioners that fit these criteria by consulting with local academic experts, reviewing government websites, and using a snowballing interview technique (Charmaz, 2006). Ideas and findings became saturated after 13 interviews (Charmaz, 2006). Interviews took place over 30-60 minutes in a semi-structured format face-to-face or by phone. Participants were from Bowen Island, the City of Vancouver, City of North Vancouver, The Corporation of Delta, District of North Vancouver, Port Coquitlam, Surrey, the Township of Langley, as well as the regional government Metro Vancouver.

The raw data was collected, anonymized, and transcribed. NVivo, a qualitiative analysis software, was used to determine trends. Key trends were interpreted and compared with climate change adaptation and urban planning literature.

2.5 Results and Discussion

2.5.1 Do practitioners think they are advocates?

Previous literature (Birkmann et al., 2010; Hallegatte and Corfee-Morlot, 2011) have placed cities at the forefront of adaptation due to their local vulnerability to physical hazards and the lack of guidance from national organizations. With this in mind, we wanted to understand what municipal practitioners perceived their role to be in climate change adaptation. The

inconsistency in responses demonstrated the conflicting views practitioners have regarding their own responsibility for action. At the two extremes, there were rationalizations for a 'low responsibility' and a 'high responsibility'. One practitioner expressing low responsibility stated, "What we do has to reflect what the community wants and what funding we have." Conversely, another practitioner expressed the alterative, "The protection of the public is our fundamental responsibility and the public might not always necessarily have the expertise that the engineers and scientists do. So it's our responsibility to keep them safe."

There were 11 unique answers to the question "What is municipalities' role in climate change adaptation," which was open-ended (Figure 2.5). The most common response acknowledged that municipalities had a responsibility to adapt areas they control, such as land, assets, utilities, and other services. Of those respondents, three spoke specifically about how a municipality was well positioned to consider long-term climate impacts and ensure that their infrastructure would be resilient in 50 or 100 years under changing climatic conditions. This is consistent with Hanna et al.'s (2014) findings that adaptation action in Canadian cities mostly related to assets controlled by the city, such as storm water management, roads, and emergency services.

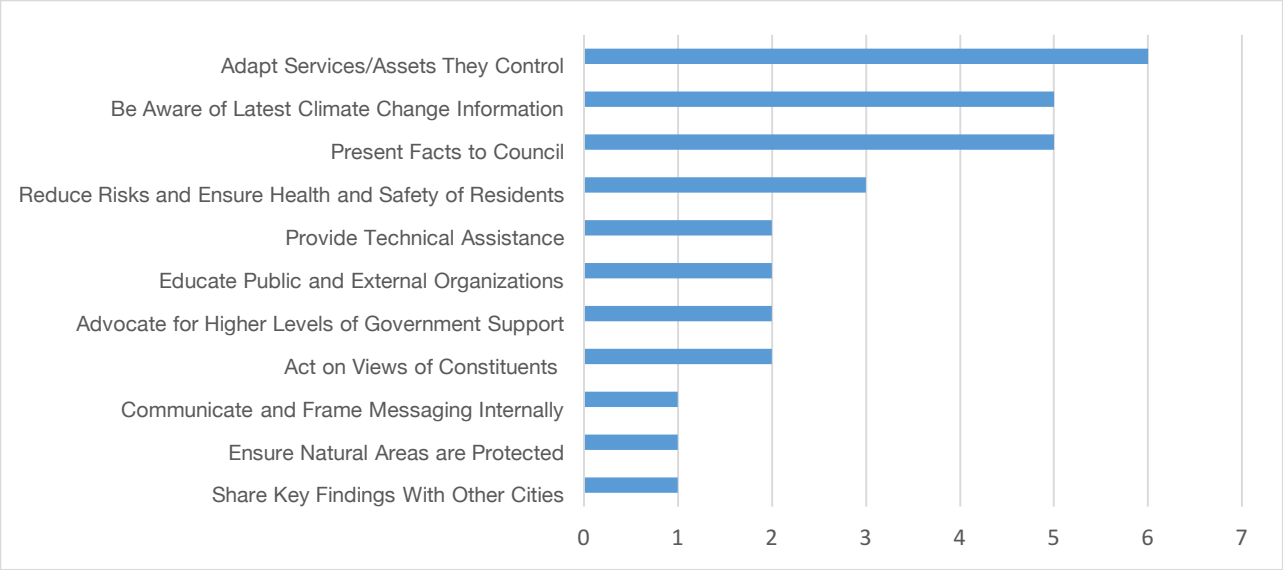

Figure 2.5 What municipal practitioners believed their main responsibilities were to local climate change adaptation (n=13).

The second most common role for municipal government expressed was a responsibility to be aware of the latest climate change information. Five out of the 13 respondents highlighted this as major role. For example, one practitioner stated, "Even though we are a regulatory authority, we also need to be a repository of information…It's up to us to be leaders in seeking out that information, digesting it, and then creating something with it."

Other key roles identified by practitioners included responsibilities to ensure citizens are healthy and safe; to provide technical assistance internally and externally; to educate public and external organizations; to advocate to higher levels of government for funds or data; to act on the views of constituents; to communicate or frame climate change messaging internally; to ensure natural areas are protected; and to share key findings with other cities.

Despite research (Burch, Perry, and Sanders, 2014) that argues that uncertainty is a barrier for adaptation planning, many interviewed practitioners did not see uncertainty as a barrier. One practitioner stated that uncertainty is "not something new. We plan around it all the

time. It's just that [climate change] is one new thing and ignoring it would be like assuming the population is going to be the same as it was in the last 20 years, which you would never do."[1]

The dichotomy between the responsibility of the councilors and of the practitioners came up as a major source of tension for several practitioners. Five practitioners stated that it was their responsibility to support their council's decision making processes by objectively presenting the alternative adaptation options. Three individuals felt it was inappropriate to advocate for a particular position; one individual even explicitly stated, "We are not an advocacy organization." Municipal practitioners should feel responsible for advocating for actions that are in the best interests of a city's residents, despite initial board support or citizen understanding. However, institutional and behavioural norms are clearly a barrier for advocacy planning.

Evidently, municipal practitioners have conflicting views about their responsibility to increase cities' capacity to adapt, especially when it comes to services and assets they do not have control over. Even though cities have significant incentive to adapt, and many cities are emerging as leaders in climate change adaptation, this does not mean that all cities feel responsible to lead climate change adaptation. Municipal practitioners are working to balance the demands of residents and councilors with the urgency of climate adaptation.

2.5.2 Why should municipal practitioners incorporate advocacy planning?

Our interviews with municipal practitioners highlighted key reasons for why planners are well positioned to advocate for climate adaptation action. As Davidoff (1965) argued, planners must recognize that their decisions and advice are never value-neutral. Many municipal

[1] This response to uncertainty was surprising considering predicting climate change is inherently more complex than predicting population growth. A possible explanation for the confidence in climate change predictions - despite uncertainty - is that practitioners in Metro Vancouver receive climate change estimates from the Province of British Columbia and Pacific Climate Impacts Consortium (PCIC). Two practitioners expressed the fact that they have so many uncertainties and decisions to make that they are grateful the Province and PCIC give them numbers they are able to easily justify to Council.

practitioners interviewed in Metro Vancouver still had a strong desire to be seen as neutral and objective. One individual stated, "Ultimately, my role is to fairly present the risks and rewards of different courses of action to elected officials and they are the ones who decide what to do… Our job to present information as objectively as possible." However, even the most technical aspects of planning had ethical implications, like forecasting (Wachs, 1982), transportation (Wachs, 1985), and other mundane tasks (Bolan, 1983). Wachs (1985) stated that "planners recognize that every act of planning pursues certain human values and that planning is in many ways a series of statements about what we take to be right or wrong" (as cited in Campbell, 2012, p. 380). Today, it is now widely accepted that values "permeate every professional issue that the planner is apt to confront" (Brooks, 2002, p.66). Even though the CIP (n.d.) calls for planners to advocate for climate action, some planners in Metro Vancouver still wish to be perceived as objective.

Some planners in Metro Vancouver did feel comfortable with their position to advocate for climate change adaptation. One individual stated that they are well positioned to advocate for adaptation because, as a planner, her role was to create plans that cover 50 and 100 year timespans. Councils' visions can be disrupted over short-term voting timespans. Several practitioners recognized they have an opportunity to advocate for adaptation during Official Community Plan reviews and through separate long-term policies, such as the Sustainability Charter. One interviewee elaborated saying that once adaptation decisions are included in these official documents, it is difficult for future councils to disregard adaptation. Another interviewee stated that their current progress on adaptation was due to a policy statement regarding adaptation that was made over a decade ago that was given new attention by the current Council. They stated that it was easier for the current Council members to accept proposed adaptation ideas because of this older document. This is consistent with Burch's (2010) research

investigating enablers of climate action in Metro Vancouver, which states the importance of explicit policy directives in determining the success of climate change responses.

Municipal practitioners also have the ability to be advocates because of their ability to incorporate different forms of knowledge – through participatory and applied research, provide information to local constituents, and empower citizens to become advocates themselves. The idea of a municipal practitioner being responsible for educating local citizens on climate change adaptation had mixed reviews among interviewees. One practitioner stated, "I think we have to [have a role in advocacy and education]. I don't know if it should just be us but I think we don't have a choice right?" Another stated, "even if we don't do anything, at the very least, people should know about it. So awareness is probably the first big one." Others felt comfortable educating citizens on climate change adaptation if the Council supported it, "if our elected officials feel that it is important to educate the public about courses of action… then absolutely we can promote certain courses of action."

However, there was some concern about disrespecting Council and the democratic system: "we do advocate for certain things but we are not there trying to convince people that climate change is real and influence for who they vote for." This reveals some of the critical flaws in Canada's representative democratic system within municipalities. Fainstein and Fainstein (1982) argue that theoretical democracy, where citizens elect representatives and then retreat from the discussion, fails due to the bureaucracy of planning (as cited in Fainstein, 2005). If local governments utilized direct democratic practices, municipal practitioners would be ethically obligated to update citizens on current planning practices – including climate change adaptation – because they would be directly accountable to all citizens. However, with representative democracy, local councilors are expected to represent the interests of their

constituents by proxy and vote on their behalf. Therefore, in cases where Council members do not see the need for supporting and funding adaptation planning, there is an awkward conflict of interest for staff members who want to raise awareness for the need with the public.

2.5.3 How can municipal practitioners be better supported to be advocates?

Municipal practitioners interviewed in Metro Vancouver identified several ways that they could be better supported to advocate for climate change adaptation. Specially, they mentioned several key networks that can help them: boundary organizations, higher levels of government, industry associations, and university and colleges.

Boundary organizations are intermediary organizations that connect science to practice (Cash et al., 2003; Corfee-Morlot et al., 2011; Guston et al., 2000). Boundary organizations could support municipal practitioners by connecting them with the latest climate science and adaptation options, especially if the boundary work was viewed as *credible*, *legitimate*, and *salient* (Cash et al., 2003; Corfee-Morlot et al., 2011), as well as when they provided *action-oriented support* (Graham & Mitchell, 2016). Three municipalities mentioned the Collaborative for Landscape Planning (CALP) because of their ability to translate science through visualization. For example, CALP developed a tool to help individuals and council members visualize projected climate impacts and potential adaptation scenarios. One participant stated that this "information proved quite powerful when presenting to elected officials the outcomes and trade offs between different alternatives."

Almost all interviewees stated that they needed additional support from higher levels of government to advocate for climate change adaptation. Many municipalities are looking to Metro Vancouver, the Province of British Columbia, and the Federal Government for direction on sea

level rise predictions and building code requirements. Practitioners stated that higher levels of government have more resources to study climate change, publish reports, and advise local communities. They can also facilitate networking and idea sharing between municipalities. Alongside the technical experience from higher levels of government, practitioners are also looking for financial support to respond. One individual stated that they need to be "pushing the provincial government and pushing the federal government to help us either fund things or provide the data that we need to make our decisions." Additionally, higher levels of government can support local adaptation planning by legislating changes. One planner stated, "In my experience, there is often change resistance. Any prospective changes to local bylaws, to standards, streetscape standards, infrastructure standards, development standards … it doesn't come about without those changes being legislated, something that we have no choice in…Saying that, top down is not fair unless there … is money to draw from." It was also noted that legislated changes could also come from industry associations, such as the Association of Professional Engineers and Geologists of British Columbia.

Finally, municipal practitioners could also be better supported through planning education and training in university and college. Interviewees acknowledged that there is a wide range of ages and backgrounds in municipal government and therefore education alone would not be sufficient to support adaptation planning. However, education should be a supplementary and required source of support for municipal practitioners – especially urban planners. Planning educators have a responsibility to provide students with both the technical tools as well as the confidence to incorporate advocacy planning in their future careers. In 1965, Davidoff believed that "there [was] tremendous need to train professionals who are competent to express their

social objectives… The great advances in analytical skills…will be of little social advantage if the proposals themselves do no have substance" (p. 337). The same is still true today.

2.6 Conclusion

Climate change poses a significant global threat to civilization and ecosystems. Urban environments are uniquely vulnerable to climate impacts because of their population density, built form, socio-economic demographics, and often close proximity to rivers and coasts. With the risk of both rapid and gradual climate impacts increasing, it is clear that conventional approaches to urban planning will be insufficient to adapt to climate change. Our research study aimed to shed light on how municipal practitioners viewed their responsibility and their municipality's role in climate change adaptation.

Interviews with key stakeholders in Metro Vancouver revealed that practitioners have mixed views in regard to their responsibility. They highly value public interests and the safety and well-being of their citizens, yet they also feel responsible for following the demands of their respective councils and local constituencies. When these interests are aligned, planners are easily able to push progressive adaptation agendas and educate local residents on the adaptation planning process. However, when councils and citizens do not feel the urgency of climate adaptation action, adaptation planning becomes more challenging for municipal practitioners. In the latter case, it is imperative that urban planners feel comfortable advocating for climate change action.

This study reveals the tendency for municipal planners to resort to a more rational comprehensive model of planning – where planners are considered objective while they present risk reduction options. This research demonstrates a hesitancy towards advocacy planning, which

is essential to influence decision makers and inspire climate action (CIP, n.d.). Municipal practitioners and planners should not be afraid to advocate for adaptation planning for the fear of not appearing 'objective' or 'neutral.' Advocacy should not be considered a dirty word, but instead it should be embraced as a core competency of urban planners, who cannot be objective because they are always evaluating decisions based on a plurality of public interests. However, municipal practitioners will struggle to adopt advocacy planning if they do not have the support of boundary organizations, which connect them to climate and adaptation information; higher levels of government, which provide funding, legislation, and research; and universities, colleges, and industry associations, which push practitioners to be confident in their role in progressive city building. Going forward, it is clear that advocacy planning should be a critical element of urban planners' 'toolbox'.

Chapter 3: The Role of Boundary Organizations: Effective Partnerships to Foster Urban Climate Change Adaptation

3.1 Introduction

As the world continues to urbanize and greenhouse gas emission increase, cities are becoming more vulnerable to both gradual and intense climate change impacts**.** Adaptation, once described as "the poor cousin of mitigation," is now unavoidable (Berrang-Ford, Ford, & Paterson, 2011, p. 25). Local adaptation action is a result of a consortium of public, private, and civic actors operating across scales and regions. Within this complex governance system, some municipal actors are emerging as leaders due to the local impacts of climate change and a lack of national direction (Rosenzweig et al., 2010). However, many cities have not yet started planning for adaptation and there are still significant barriers to implementation for cities that have initiated the planning process (Burch, 2010; Hanna et al., 2014; Moser & Ekstrom, 2010).

This research builds on previous urban climate governance research (Anguelovski & Carmin, 2011; Burch, 2010) to focus on how partnerships with boundary organizations influence adaptation planning and implementation within municipal governments. Boundary organizations are emerging to connect science to practice (Cash et al., 2003; Corfee-Morlot et al., 2011; Guston et al., 2000; Lemos, Kirchhoff, & Ramprasad, 2012; Tribbia & Moser, 2008). Partnerships with boundary organizations offer a governance approach that disseminates knowledge, builds capacity, and engages more participants in the adaptation planning process (Bauer & Steurer, 2013). However, little is known about specific management strategies that create successful boundary organizations (Crona & Parker, 2012) and there are few empirical cases that describe how local partnerships improve adaptation planning at the local level in

practice (Harman, Taylor, & Lane, 2014).

The objective of this study was to understand how boundary organizations can better support municipal adaptation from the municipal practitioners' perspective. Building on previous research that investigated adaptation trends internationally (Aylett, 2014; Biagini et al., 2014) and within Canada (Hanna et al., 2014), a case study was conducted in Metro Vancouver, British Columbia to determine practical strategies boundary organizations should incorporate to better support municipal adaptation planning.

3.1.1 Multi-Level Governance and Climate Change Adaptation

The study of new approaches to urban governance is a prominent research topic in climate change literature (Archer et al., 2014). Urban climate governance is defined as "ways in which public, private, and civil society actors and institutions articulate climate goals, exercise influence and authority, and manage urban climate planning and implementation processes" (Anguelovski & Carmin 2011, p.1). While there are several conceptual models of governance, the multi-level governance model is particularly applicable to climate action because it outlines the multi-scalar, interconnected actors and partnerships involved in adaptation (Bauer & Steurer 2014; Carter et al., 2015; Castán Broto & Bulkeley, 2013).

Hooghe and Marks (2003) have described two distinct forms of multi-level governance. Type I multi-level governance is a hierarchical authority (for example a federal ministry of climate change) with a limited number of discrete jurisdictions below (such as provincial and local climate change ministries) (Hooghe & Marks, 2003). However, climate change adaptation actors rarely function in a purely hierarchical function with discrete jurisdictions and focuses.

Type II multi-level governance illustrates how many state and non-state actors act across all scales, overlapping in jurisdiction, and partnering on initiatives (Hooghe & Marks, 2003) (Figure 3.1). This approach is similar to the polycentric management approach, which recognizes the overlapping and interconnected actors that shift governance away from a hierarchal model (Betsill & Bulkeley, 2006; Ostrom, 2010). Type II multi-level governance and polycentric management provide a better categorization of adaptation actors who operate at different scales, overlap in jurisdictions, and form partnerships with public, private, and civil society players.

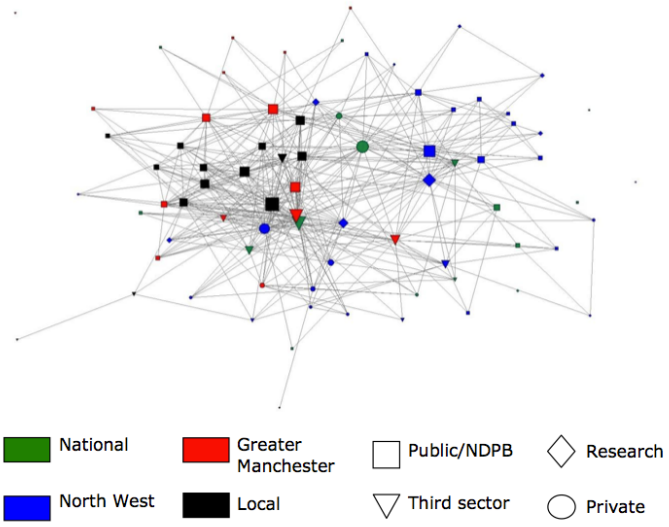

Figure 3.1 Actors in Multi-Level Governance: Type II (adapted from Kazmierczack, 2012) (shape of symbol represents actor; size of symbol represents level of collaboration)

Adaptation actors include government, research institutions, not-for-profit organizations, community-based organizations, First Nation groups, and private industry. Within a complex governance system, many municipal governments are leading the way on climate adaptation efforts (Cashmore & Wejs, 2014; Hallegatte & Corfee-Morlot, 2011; Rosenzweig et al., 2010). Urban municipal governments have extensive incentive to adapt to climate change because they

are vulnerable to physical hazards and are responsible for cities with unique socio-economic systems (Birkmann et al., 2010; Hallegatte & Corfee-Morlot, 2011).

While cities have incentive to adapt, many cities have not yet started preparing for climate change adaptation. In Canada, it is estimated that approximately 45% of Canadian communities have no adaptation plans and are not planning on creating one soon (Hanna et al. 2014). Barriers to adaptation include the unavailability of local climate change projections, limited funds, lack of vertical collaboration (Moser & Ekstrom, 2010), as well as regulatory limits, institutional inertia, or internal staff behavioural challenges (Burch, 2010), and the science-policy disconnect (Tribbia & Moser, 2008).

3.1.2 Boundary Organizations and Climate Change Adaptation

The science-policy disconnect is a critical barrier to many environmental planning decisions, whereby policy decisions are made without incorporating recent, robust scientific information (Tribbia & Moser, 2008). Since environmental planning decisions are "wicked and messy" (Rittel & Webber 1973), they require adequate scientific resources to improve evidence-based decision making (Parker & Crona, 2012; Rose, 2014). However, while scientific information is critical, "better information" and "more information" does not necessarily result in better decision making (Tribbia & Moser, 2008, 317).

Science needs to be usable and relevant to the needs of municipal decision makers to influence policy makers (Dilings & Lemos, 2011; Parker & Crona, 2012; Sarewitz & Pielke 2007; Tribbia & Moser, 2008). Tribbia and Moser (2008) explained that scientific information is often disconnected from policy because most researchers are incentivized to publish primarily in academic journals. However, practitioners often do not have the time to sift through academic

journals and jargon, and the information published may not fit their specific needs. Significant research has been conducted to investigate how science can be more usable for policy makers (Dilling & Lemos, 2011) and effective in influencing social responses to public issues (Cash et al., 2003). Many tools have been proposed and studied to address the science-policy disconnect, including analytical deliberation (Stern, 2005), community-based adaptation (Reid & Huq, 2014), community-based participatory research, participation action research (Chevalier & Buckles, 2013). Boundary organizations have been proposed by Tribbia and Moser (2008), and other climate change adaptation researchers (Corfee-Morlot et al., 2011; Bauer & Steurer, 2013; Hoppe & Wesselink, 2014), as another critical tool to connect science with practice and support municipal climate change adaptation planning.

Boundary organizations are actors that can connect academics to policy by (1) creating boundary objects (i.e. conceptual models, research), (2) mediating between policymakers and scientists, and (3) operating at the forefront of both research and policy (Guston, 2001). Boundary organizations can be non-profit groups, private consultants, or embedded within research institutions or governments. Boundary theory emerged out of research in environmental assessments (Guston, 2001) and has since been applied more generally to help scientific information more effectively influence social policy (Corfee-Morlot et al., 2011). Cash et al. (2003) stated that in order for science to influence policy making, all stakeholders must perceive the science to be *credible, salient*, and *legitimate*.

Corfee-Morlot et al. (2011) considered boundary organizations to be a valuable intermediary organization that could address the science-policy disconnect inherent in municipal adaptation planning. Building on Cash et al. (2003), Corfee-Morlot et al. reaffirmed that successful boundary organizations produce boundary objects (i.e. assessments or policy advice)

that are perceived as *credible*, *legitimate*, and *salient*. First, boundary organizations need to produce scientific assessments that are *credible* to the scientific community yet also accountable to policy standards. However, it is not sufficient to just produce policy-driven science. The research process must also be perceived as *legitimate*. This requires boundary organizations to involve key stakeholders and decision-makers throughout the process (Groot et al., 2014; Jasanoff, 2004; Ostrom et al., 2002) to co-produce knowledge (Hegger & Dieperink, 2014). The benefits of co-produced climate science have been expressed extensively in climate and environmental literature (Elander, 2002; Guston, 2001; Lemos & Morehouse, 2005; Hegger & Dieperink, 2014; Jasanoff, 2004). Lemos and Morehouse (2005) define successful co-production of knowledge as a process of interdisciplinarity, stakeholder participation, and production of usable knowledge. Finally, the *salience* of the research produced is increased if the science is framed in a relevant and accessible format for the users (Lemos, Kirchoff, & Ramprasad, 2012).

Boundary organizations can operate at multiple scales within multi-scalar governance systems. Hoppe et al. (2013) presented the multi-level conceptual framework for boundary work to demonstrate how actors at different scales influence policy (Figure 3.2). The Intergovernmental Panel on Climate Change (IPCC) is a well-known boundary organization that operates primarily at national and international scales. The IPCC synthesizes and translates hundreds of scientific papers for national policy makers. Ouranos is an example of a Quebecois boundary organization that operates on regional and local scales to acquire and develop climate knowledge to support local policy makers develop and implement adaptation options. Our research in Metro Vancouver investigates the relationship municipal planners have with boundary organizations that operate primarily on local and regional scales.

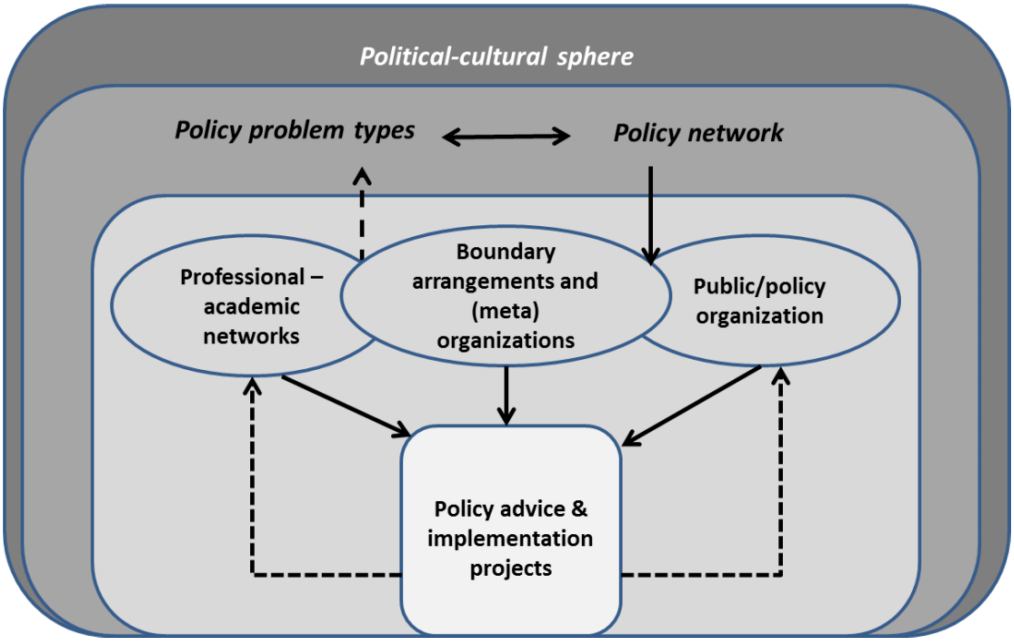

Figure 3.2 Multi-level conceptual framework for boundary work (Hoppe et al., 2013)

Research on the role of boundary organizations and climate change adaptation has been growing in recent years (Corfee-Morlot et al., 2011; Bauer & Steurer, 2013; Hoppe & Wesselink, 2014; Lemos et al., 2014; Parker & Crona, 2012; Tribbia & Moser, 2008). However, while boundary organizations have been proposed as an effective partner to help cities plan for adaptation (Tribbia & Moser, 2008), Harman, Taylor, and Lane's (2014) systemic review of partnerships indicate that many partnerships are struggling to influence urban planning at the city scale. They stated that an obvious empirical gap in the literature is knowledge on how partnerships at sub-regional scales can more effectively foster adaptation action. Similarly, Parker and Crona (2012, p. 263) stated that "little is known about how to create successful boundary organizations, how they relate to their constituents, and the most effective boundary management approaches and on-the-ground administrative strategies." Therefore, this case study in Metro Vancouver aims to add to the literature by providing empirical evidence for how

boundary organizations operate at a sub-regional scale to influence municipal planners' adaptation work and provide tangible strategies to improve boundary management approaches.

To investigate how sub-regional or municipal actors incorporate new climate science and adaptation planning methods, it is critical to understand organizational change theory. Boundary organizations looking to influence change can learn from recent findings in organizational change management literature. Al-Haddad and Kotnour's (2015) literature review on organizational change theory summarized three key change enablers within organizations: knowledge and skills; resources; and commitment. They divided change methods into systematic change, which is a process-based approach, or change management, which is a culture-based approach. Organizational theory literature has just begun to consider how an organization, such as a municipality, should change and respond to climate change (Busch, 2011; Winn & Kirchgeorg, 2005).

Attempting to connect climate change adaptation and organizational theory literature, Busch (2011) developed three organizational capabilities that enable climate adaptation within organizations: climate knowledge absorption, climate-related operational flexibility, and strategic climate integration. These three organizational criteria are process and culture based. Similarly, within climate governance literature, Burch (2010) stated that responses to climate change at the municipal scale must be both process and culture based: change methods must incorporate both an organizational culture that promotes innovation and collaboration, as well as a process that 'institutionalizes' climate action within current operations. We hypothesize that boundary organizations have the ability to support organizational change within municipalities with both culture and process based methods. Additionally, boundary organizations may create an enabling

environment for change because they have the ability to provide knowledge and skills, and they can connect cities with additional financial and human resources.

3.1.3 Metro Vancouver Case Study

Metro Vancouver was chosen as a case study to better understand how municipal practitioners are working with boundary organizations to prepare for climate change in practice. The region of Metro Vancouver is situated on the west coast of Canada in the province of British Columbia and is a partnership of 21 municipalities, one Treaty First Nation, and one Electoral Area. Metro Vancouver has a population of 2,400,000 (Statistics Canada, 2012). The City of Vancouver accounts for 600,000 of those local residents, and the City of Vancouver is one of the most densely populated municipalities in Canada (Statistics Canada, 2014).

Climate change is projected to impact Metro Vancouver in both gradual and abrupt ways. Gradual impacts include increased annual precipitation, higher annual temperatures, and rising sea levels (Pacific Climate Impacts Consortium, 2012). The long-term impacts of these gradual changes are particularly concerning. For example, a one-meter sea-level rise is projected to inundate 15,000 hectares of residential and industrial urban areas (Yin, 2001). Infrastructure at risk to flooding and extreme rain includes over USD $55 billion of port assets (Nicholls et al., 2008), Vancouver's International Airport, sewer systems, waste treatment facilities, and highways. In May 2011, British Columbia's Ministry of Environment released recommendations that Metro Vancouver should plan for a sea level one-meter higher by 2100 based on the most recent IPCC projections; dike improvements are projected to cost $9.5 billion (Ministry of Forests, Lands, and Natural Resource Operations, 2012).

Metro Vancouver also faces sudden extreme events linked to climate change, including extreme heat and drought, increased storm surges, extreme precipitation, flooding and landslides, and coastal erosion. The Pacific Climate Impacts Consortium (2012) predicted extreme heat events will be occurring three times as frequently by 2050 in Metro Vancouver. In the summer of 2009, Metro Vancouver experienced a deadly heat wave (Environment Canada 2013a). Kasatsky, Henderson, and Pollock (2012) estimated that approximately 110 people died in the Lower Mainland due to the heat.

Metro Vancouver is within the Fraser River Basin and channels approximately one-quarter of British Columbia's water. Communities near the Fraser River are at risk of flooding due to poor land use planning and snowmelt, but also because of climate change induced extreme rainfall (Owrangi, Lannigan, & Simonovic, 2014). Metro Vancouver's brittle system was tested in November 2006 during one of the most intense rain events in recent years. This extreme rain event resulted in a boil water advisory for two million residents, closure of seven provincial highways, power cuts for over 200,000 people, and 150 home evacuations (Environment Canada, 2013b). Going forward, the Pacific Climate Institute Consortium (2012) projected that the expected increases in rain volume, storm intensity, and sea level rise under climate change will make the region more vulnerable to street flooding, sewer backups and overflows, transportation malfunctions, and shoreline damage. With Metro Vancouver's recent climate hazards and projected changes, multiple actors are collaborating to plan for adaptation.

3.1.4 Multi-Level Adaptation Actors in Metro Vancouver

A polycentric consortium of actors at the national, regional, and local levels influence adaptation in Metro Vancouver. Interestingly, the adaptation resources provided by both the

Canadian government and the provincial government call for cities to be the main implementers of adaptation initiatives (Richardson, 2010; Richardson & Otero, 2012). However, it is unclear how municipal practitioners consider themselves responsible for adaptation action.

At the national level, the Climate Change Impacts and Adaptation Division operates under Natural Resources Canada. In 2009, they launched the Regional Adaptation Collaborative (RAC) program to build regional collaboratives focused on translating adaptation knowledge into action. The British Columbia RAC is run by British Columbia's Ministry of Environment and the boundary organization Fraser Basin Council. In 2012, Natural Resources Canada also launched the "Adaptation Platform" to create working groups around specific industry sectors and themes.

The Province of British Columbia is taking a more proactive approach to climate change adaptation than the federal government. In 2010, British Columbia published a provincial adaptation strategy to guide local adaptation action. The province has developed several resources to help communities plan for sea level rise and storm surges (Ministry of Environment, n.d.) and actively works to mainstream adaptation across other departments. Similar to the federal government, the provincial government supports projects that foster local action, positioning local communities as adaptation executors.

Local adaptation actors in Metro Vancouver include municipal governments, academic institutions, civil society groups, First Nations groups, private industry, and boundary organizations. The municipalities within Metro Vancouver vary in the responses to climate change. Only five municipalities have adaptation strategies or resources published online: The Corporation of Delta, The City of North Vancouver, The District of North Vancouver, The City of Surrey, and The City of Vancouver.

3.2 Methodology

Qualitative interviews were conducted to elicit the views and opinions of municipal adaptation planners and practitioners. This method provided practitioners with an opportunity to share their insight and validate historical information. City participants were purposefully selected (Creswell, 2014) based on two criteria: (1) employment, or previous employment, at a municipality within Metro Vancouver and (2) involvement in the adaptation planning or implementation process. While multiple stakeholders are critical to urban climate adaptation, such as boundary organizations, research organizations, civil society, First Nation groups, and private industry, we specifically interviewed municipal staff to critically investigate one key relationship that exists to support municipal adaptation planning: the relationship between city staff and boundary organizations.

Twenty-two municipal practitioners that fit these criteria were identified through consultation with local academics and boundary groups, government websites, and a 'snowballing' technique. Of those identified, thirteen municipal practitioners participated in the study, which is when ideas became saturated (Charmaz, 2006). Interviewees were from Bowen Island, the City of Vancouver, City of North Vancouver, The Corporation of Delta, District of North Vancouver, Port Coquitlam, Surrey, the Township of Langley, as well as the regional government Metro Vancouver. Practitioners were municipal staff that had a key role in adaptation planning within their municipality, and held positions in planning, engineering, environment, and/or sustainability.

The individuals who declined to participate stated this was due to insufficient staff time, not lack of interest. Interviewees participated in a 30-60 minute semi-structured face-to-face or phone interview. The two main research questions were (1) how do boundary organizations

operate at the local level to support municipal adaptation planning and (2) what practical strategies should boundary organizations incorporate to better support municipal adaptation planning.

The term boundary organization was defined for participants as intermediary organizations that connect climate science to municipal practice, and several local examples were provided. Interview questions focused on how staff currently incorporated climate change science and adaptation information, the benefits and challenges of working with boundary organizations, and recommendations for how boundary organizations could better support municipal actors plan for climate change adaptation.

After the raw data were collected and transcribed, the data were anonymized. Qualitative analysis software, NVivo, was used to group trends within and across categories. This allowed common themes across the data to be extracted. These themes were interpreted and compared to adaptation conceptual models.

3.3 Results and Discussion

This study investigated how boundary organizations could better support municipal action on adaptation. Harman, Taylor, and Lane (2014) called for more research on how partnerships operate at the sub-regional scale to foster adaptation. Parker and Crona (2012) specifically stated the need to understand "on-the-ground administrative strategies" for effective boundary management. Our results build on literature on boundary organizations, organizational change, and action-oriented support by providing practical strategies specifically for boundary organizations from the municipal practitioners' perspective. As a way of structuring our results, we grouped recommendations based on conditions outlined by Cash et al. (2003) and Corfee-

Morlot et al. (2011) for boundary organization to be influential – *salience, legitimacy*, and *credibility* – as well as an additional condition of *action-oriented support*.

Overall, these results operationalize core conditions of boundary organizations and provide process-based and culture-based strategies (Al-Haddad & Kotnour, 2015; Burch, 2010; Busch, 2011) to support municipal adaptation action. Additionally, the results reveal inherent tensions between criteria and demonstrate why boundary organizations should be viewed as a necessary, *but not a sufficient*, tool to support local adaptation. Boundary organizations are not a panacea or silver bullet solution.

3.3.1 Credibility: Reputation and Clear Mandate

Corfee-Morlot et al. (2011) described *credibility* briefly as "whether the science assessment has met acceptable quality standards as judged by other scientists or the peer expert community" (p. 181). While this is critical, municipal practitioners in Metro Vancouver stated boundary objects – and the organizations themselves – must have credible reputations and mandates.

When municipal practitioners were asked why they work with specific boundary groups, most explained it was because of their reputation. They are looking for reputable information to defend to city council. A reputation was built from a group's affiliation with a university institution, funding from the province, word of mouth, or a long-term relationship. One individual explained that a boundary group had "been here for twenty years so people understand that they have a very good sense of the community...I think that's where they get that trust from." Several municipal practitioners showed how new boundary organizations were

establishing their reputation by starting with small projects and proving their impact or offering tools and services for free.

Having a clear mandate is also critical to better support municipal climate change adaptation. One of the biggest frustrations regarding boundary organizations was the sheer number of them and their tendencies towards mission drift. One practitioner started the interview by stating, "First we have to stop having so many boundary organizations." While they are clearly a valuable resource to municipalities, practitioners complain that boundary organizations start to suffer from mission drift: "You see [boundary organizations] that have a certain mandate and then they try to expand their mandate into someone else's who is already doing a pretty good job. Don't waste your time." They stated that boundary organizations end up "adding to the noise" when they should instead "be clear about what they do and why it's different." Additionally, participants stated that boundary organizations must be aware of what other boundary groups do and show respect to fellow researchers. Two participants recognized that the power of these groups is in their ability to join forces and provide a larger voice for adaptation.

3.3.2 Legitimacy: Collaborative Research Practices and Facilitation

Boundary organizations' credibility might help establish an initial relationship, but the next critical stage of influence relates to the creation of adaptation knowledge. Knowledge creation was mentioned in all interviews a total of 32 times. This reaffirmed Busch's (2011) first enabling criteria for organizational change surrounding climate change: climate knowledge absorption. Climate knowledge absorption is a product of knowledge creation and utilization (Busch, 2011). Legitimacy is a requirement for culture change that enables knowledge creation and utilization. Adaptation practitioners mentioned two main strategies for boundary

organizations to produce adaptation knowledge: co-production with municipalities and facilitation.

3.3.2.1 Collaborative Research Practices

Collaboration and co-production of knowledge was mentioned in seven out of the 13 interviews with practitioners. Practitioners explained that collaborative research practices were critical to help understand a municipality's needs, frame research findings, and provide support after the research project.

Practitioners criticized boundary organizations that failed to adequately understand a municipality's needs. Two practitioners mentioned that when municipalities are not engaged early on, results tend to be too high level to be of any use. Other practitioners complained that some boundary organizations would disappear for a long time only to come back with too much information to sort through, a concept Hanger et al. (2013) describes as a 'loading dock' of information.

However, practitioners also had success stories to share regarding effective collaboration throughout the process. One interviewee was asked to be a project advisor in a study being organized by the Credit Valley Conservation (CVC), which was acting a boundary organization between researchers and a municipality. CVC had students and professors present findings throughout the study to project advisors, who were practitioners, via webinars and phone meetings. Here practitioners had the opportunity to guide them to more accurate information or correct misleading statements before they published their results.

Co-production of climate adaptation information is also critical to ensure results are effectively framed depending on target audiences. For example, one municipality was acutely aware that the farming community in their region would be more receptive to discussing

weather, crop loss, and resilience but less open to discussing anthropogenic climate change. It is critical that boundary organizations work closely with municipalities to understand how their project results should be framed to have the greatest influence on action.

To ensure a boundary organization's work has the greatest influence after the research project has ended, practitioners stated that boundary organizations needed to remain project 'owners.' University-embedded boundary organizations are made up primarily of professors and students. A complaint, particularly for thesis projects, is that often no one takes ownership of a project once it is complete. Therefore, if municipalities want to use this information or follow up, for example to see if a project considered subsidence in sea level rise calculations, there needs to be someone at the boundary organization that can support them.

3.3.2.2 Facilitating Networking

Eleven out of 13 municipal practitioners stated facilitation as a unique asset of boundary organizations. Facilitation and stakeholder engagement is a critical ingredient to improve collective decision making regarding environmental resources (Ostrom, 1990, 2000). Battilana and Casciaro's (2012) theory of organizational change highlighted that organizations that have more structural holes are more likely to generate novel ideas. In other words, the more open an organization's network is, the less likely they are to suffer from normative pressures (Krackhardt, 1999) and redundancy of information (Ruef, 2002). Boundary organizations create opportunities for municipalities to gain outside perspectives and share them internally with more confidence.

Boundary organizations can support several types of facilitation. Firstly, boundary organizations can connect neighbouring municipalities to facilitate a regional approach to

climate change impacts. The Fraser Basin Council was praised in the interviews for their ability to facilitate municipal discussion on regional flood management in Metro Vancouver. One participant stated, "When it comes to flood management everyone is going to take a different approach. [Municipalities] have different priorities, approaches, resources, so having someone bring everyone together and talk about ideas keeps pushing the [work] forward."

Secondly, boundary groups influence adaptation via facilitation by providing an opportunity for cities to learn from each other. Tools listed included conferences, working groups, webinars, and e-newsletters. One participant highlighted that one boundary organization in particular provided an opportunity for "such a valuable conversation… We had people all the way from Durham Region present and [share] how their finance department was involved… I don't know if I would have ever learned that otherwise." Another individual explained the savings his municipality had by having access to this network: "If I had to hire a consultant to do that type of research for me and phone up all of these municipalities and ask that question it would cost me way more than the membership would cost."

Thirdly, boundary organizations use facilitation to create a neutral space for public and private interest groups to create adaptation strategies together. Their neutrality allows them to be viewed as professional and scientific and not politically biased. Municipal practitioners felt that this helped bridge the gap between public and private adaptation interests.

However, municipal practitioners also provided input into how boundary organizations could better use facilitation to influence adaptation. First and foremost, municipal staff stated that boundary organizations needed to spend money on *good* facilitation. One individual urged, "Facilitators are worth the money…. They need to hire someone else because scientists and engineers are *not* good at communication. We all know this."

Municipal practitioners also complained that boundary organizations should make a bigger effort to encourage facilitation *within* a municipality. There is usually one point-person for adaptation at a municipality. However, one of the biggest challenges for that individual is spreading adaptation messages out to other departments. Boundary organizations should reach out to staff in engineering, planning, environment, and/or finance to create adaptation champions throughout the organization. This finding highlights the role of communication in facilitation. Cash et al. (2003) state that communication is a core strategy to ensure knowledge is perceived as legitimate – as well as credible and salient. Effective communication is more than articulating the problem and communicating the needs of stakeholders; it also consists of generating interest within city hall. Communication must be active, iterative, and inclusive (Cash et al. 2003).

This recommendation speaks to the culture-based aspects of change management. As stated earlier, organizational change requires process strategies and culture-based strategies. While boundary organizations promote a culture of innovation by expanding staff networks outside their city, this effort proves futile if their local municipality is not receptive to a culture of climate innovation. This is consistent with research by Battilana and Casciaro (2012), who stated that more open networks are more likely to *generate* novel ideas. However, more cohesive networks were more likely to *adopt* innovative ideas (Fleming et al., 2007; Obstfeld, 2005). Therefore, it is not surprising that municipal staff acknowledge the positive benefit of networking to generate novel ideas, but are also quick to point out the associated implementation challenges. Therefore, facilitating adaptation discussions within a municipality is a critical step to help cities adopt innovative adaptation ideas.

The results of these interviews indicate boundary organizations can influence municipal adaptation by collaborating to co-produce knowledge, and by providing facilitation between, and within, municipalities, and between public and private interest groups.

3.3.3 Salience: Acquiring and Translating Science

Boundary organizations must provide resources that make science *salient* and accessible to a municipal practitioner. Boundary organization's ability to translate relevant science for practitioners was mentioned 32 times by 10 interviewees. Boundary organizations were influential when they acquired new and localized science and provided resources that translated the science. Influential communication strategies included online platforms, visualizations, webinars, and design charettes. However, boundary organizations could be more influential when translating science if they had a better understanding of municipal tools and resources, and provided faster and more specific studies.

Boundary organizations exist to prevent the politicization of science (Guston, 1999; 2001) and to improve the flow of information to end-users (Tribbia & Moser, 2008). All interviewed municipalities in Metro Vancouver were involved with boundary organizations to access climate change information and adaptation strategies. While many municipalities had scientists on staff, no municipality had climate scientists and therefore they all relied on external expertise to help project climate impacts in their municipality. The Pacific Climate Impacts Consortium (PCIC) was mentioned in 12 of the 13 interviews because they provided local, downscaled climate modelling for Metro Vancouver. While some municipalities in Metro Vancouver have hired PCIC as a consultant, others take advantage of their free online tool: Plan2Adapt. Plan2Adapt has an intuitive interface that provides future projections for climate

changes, including temperature, precipitation, and snowfall. Their work was praised for its simplicity and policy applicability.

One significant barrier for climate adaptation at the municipal scale can be city councils' approval of adaptation plans or budgets for adaptation work (Aylett, 2014; Burch, 2010). Three municipalities mentioned the Collaborative for Landscape Planning (CALP) because of their ability to translate science through visualization. For example, CALP launched a website to help individuals visualize projected climate impacts and potential adaptation scenarios. One participant stated that this "information proved quite powerful when presenting to elected officials the outcomes and trade offs between different alternatives." Visualizations are a soft tool based on motivating action by changing a municipality's culture.

Municipal practitioners had numerous recommendations for boundary organizations pertaining to translating science and connecting it with policy. Firstly, several organizations mentioned that boundary organizations need a better understanding of municipal tools and resources. One individual stated that boundary organizations need an "understanding of what development permits are, an understanding what by-laws are, an understanding of the building code, and how they can implement actions at the municipal level. So when there's messaging that comes out of the science, you're specifically targeting an opportunity within municipal systems." Another noted, "They don't understand the local government world. Yes, we would love to make scientifically informed policy decisions, and we do our best to do that, but we also have to integrate it with the political issues at hand." They need to be aware of the limited time and budgets many municipalities are working with. Practitioners recommended that, after relationships are established, boundary organizations should take advantage of disseminating

information online and only hold strategic meetings. However, this could hinder their ability to co-create resources.

Parker and Crona (2014) highlight that boundary organizations can struggle to connect science to policy because of the incentives that exists within the systems they operate. They determined that university-based boundary organizations were expected to be "all things to all people all of the time" (p. 285). Municipalities expected them to act as consultants and provide real time, interdisciplinary, applied research; academic institutions rewarded boundary staff based on contributing long-term, basic, disciplinary knowledge through peer-reviewed publications. Boundary organizations that exist outside academic institutions face similar conflicts of accountability with funders, internal strategic plans, and staff.

When translating science, municipal staff mentioned that their municipalities wanted faster and more specific research. Two interviewees shared the same frustration that the scientific rigour that is brought by boundary organizations "is value-add but it tends to validate what cities already know…It felt like preaching to the choir." Additionally, many research groups working directly with municipalities had a tendency to focus on the macro-scale and did not go below the surface. The importance of collaboration during research was mentioned as a solution and, as discussed above, was also highlighted as a key requirement for influential boundary organizations.

2.3.4 Action-Oriented: Tools for Action and Funding Mechanisms

Our study suggests that in addition to credibility, legitimacy, and salience, boundary organizations need an additional quality to influence municipal adaptation; they need to be *action-oriented*. Action-oriented support relates directly to the process-nature of change

management. While substantial literature exists that describes action-based decision-making processes – such as tactical urbanism, community-based participatory research, and participation action research – our research explicitly highlights its relevance to boundary organizations' management practices. This finding is where our research deviates and builds on boundary organization theory (Corfee-Morlot et al., 2011). Six out of the 13 practitioners stressed the need for boundary organizations to explicitly support action and implementation. Two main strategies were mentioned: provide funding mechanisms and/or provide action-oriented processes.

3.3.4.1 Funding Mechanisms

Many practitioners have cited budget constraints as a barrier for climate adaptation research and action. Even though other researchers, such as Burch (2010), have suggested that the lack of prioritization is the root cause of perceived budget barriers, practitioners still believed they were limited by financial constraints. Three practitioners recognized that a significant benefit of working with boundary organizations is that they build capacity for research and are often able to bring funding to cities. This was particularly true for smaller municipalities. Practitioners recognized that boundary organizations often represent broader groups that fund their work and can bring federal money to local municipalities. One stated, "That makes it much easier to work with them obviously. If they say 'I want to do a big research project' and it's going cost a $100,000 and they pay for that, then it is going to happen." Two practitioners working in adaptation stated that boundary organizations actually funded their first few months with a municipality to get the adaptation plans off the ground. Both continued working at the organizations afterward.

Lemos et al. (2014) demonstrate how boundary organizations can innovate and expand their impact through creative funding mechanisms, while minimizing transaction costs. Through a *key chain approach*, a boundary organization can partner with end-users to fund separate projects. In a *linked chain approach*, a boundary organization can partner with other boundary organizations to customize information for end-users. In a *network chain approach*, a boundary organization can play a facilitation role in connecting boundary groups and end-users to maximize knowledge translation. Ultimately, boundary organizations that are able to provide funds, provide free resources, and direct municipality to funding mechanisms are going to be more influential.

3.3.4.2 Tools for Action

Several practitioners mentioned that they are looking for tools that generate action. Boundary organizations cannot simply rely on "hucksterism," as one practitioner called it. Hucksterism describes an individual who is excited and preaching a piece of information. While passion is important, one practitioner urged boundary organizations to recognize that "this is their own personal journey around learning and it might not be the journey of the audience." Two practitioners were concerned that some information translated by boundary organization was designed to "shock and awe" or "be alarmist in nature." While they stated those messages have their place, they are looking to boundary organizations to support implementation. ICLEI Canada was praised by several municipalities for their Building Adaptive and Resilient Communities (BARC) program. ICLEI Canada's new BARC program now has 19 members including six from Metro Vancouver: Delta, City of North Vancouver, District of North Vancouver, Surrey, City of Vancouver, and Metro Vancouver. The BARC program provides a

comprehensive framework and online tool to help communities develop and implement an adaptation plan. This framework has been cited as helpful to conduct vulnerability assessments, identify risks, create climate change adaptation plans, and move work forward. Practitioners are looking to ICLEI Canada to "continue to encourage us…Now we need a fire under our butts to get to the implementation and the monitoring and reviewing. We all know those are the two hardest steps."

It is not enough for boundary organizations to be credible, legitimate, and salient. This research demonstrates that if boundary organizations want to influence cities they also need to provide practitioners with action-oriented support. Ultimately, boundary organizations play a critical role in urban climate governance and should be considered an effective mechanism for adaptation action at the municipal scale. If national and regional governments are looking to cities to become leaders in climate change adaptation, boundary organizations need to ensure that they are connected with the best, most relevant science, financial resources, and planning tools. While boundary organizations are only one actor within multi-level climate governance, the practical strategies revealed through this research aim to improve the impact of this key relationship.

3.4 Conclusion

The aim of this study was to provide insight on how boundary organizations function at the municipal scale and propose concrete management strategies for boundary organizations that more effectively foster climate change adaptation. The results of this study validated themes in the boundary organization literature on credibility, legitimacy, and salience (Cash et al., 2003; Corfee-Morlot et al., 2011), action-oriented decision making (Chevalier & Buckles, 2013), as

well as change management theories (Al-Haddad & Kotnour, 2015; Busch, 2009). Our findings built on these themes to operationalize these terms with 'on-the-ground' administrative strategies, which was identified as a gap in the literature (Parker & Crona, 2012). Credibility was seen as a function of trusted relationships and proven experience. Legitimacy related to co-constructivist views of knowledge creation and facilitation. Salience was possible through communication targeted to municipal planners and councilors and by providing relevant science in a timely manner. In addition to credibility, legitimacy, and salience, boundary organizations must also provide action-oriented support to foster municipal adaptation. Not surprisingly, the two main functions of action-oriented support related to providing funding and process-based tools.

However, the results also reaffirm that boundary organizations are not a silver-bullet solution to municipal adaptation action. Aylett (2014) stated lack of funding is cited as the main barrier to municipal adaptation. 'Competing priorities' was cited as the second most significant barrier. Burch (2010) stated that perceived funding barriers are actually a result of prioritization challenges. Aylett stated that Canadian cities reported "the highest rates of being affected by a lack of strong leadership from senior management (53%) and from regional or national government (73%)" (p. 5). While the science-policy disconnect in of itself might not represent a top adaptation barrier, it is highly interconnected with resource allocation, prioritization, and leadership. Having access to credible, legitimate, salient, and action-oriented adaptation information would help municipal practitioners better advocate for adaptation funding and resources. Polycentric and multi-scale governance reveals the many actors involved in supporting local adaptation, and these results demonstrate that boundary organizations can be more effective in supporting local, municipal action.

The transferability of learning is challenging, as it is difficult to observe the direct cause-effect relationships between partnerships and implemented adaptation (Harman, Taylor, & Lane, 2014). The approach this study took was to speak directly with municipal practitioners to help identify the support they believed would be most valuable to plan for climate change. This research focused primarily on the views of municipal practitioners, but more research is required to understand the perspective of other adaption actors operating at various scales – including boundary organizations, higher levels of government, civil society, First Nation groups, and the private sector. Going forward, more research is also required to understand how different actors feel personally responsible for climate change adaptation planning.

Chapter 4: Thesis Conclusions

Urban planners have an opportunity to be agents of change to support municipal adaptation planning because they are forward thinking and centralized within local governments (Archer et al., 2014). Urban planners can foster negotiation among stakeholders, coordinate capacity, facilitate implementation, and serve as a point of consistency in the adaptation planning process (Hanna et al., 2014). However, current planning models lack strategies to navigate the political and power contexts of planning (Forester, 2008), which is essential to advocate for adaptation action. The first objective of this thesis explored the role of advocacy planning in municipal climate change adaptation.

The second objective of this thesis explored the role of boundary organizations in planning for municipal adaptation. Boundary organizations have been proposed as an effective strategy to support municipal adaptation planning (Tribbia & Moser, 2008). However, it was unclear how these partnerships operated at the sub-regional scale to foster adaptation (Harman, Taylor, & Land, 2014) and how they could effectively operate to better support municipal adaptation (Parker & Crona, 2012).

This study interviewed municipal practitioners working in adaptation planning to better understand their perceived responsibility for adaptation and provide strategic advice to boundary organizations that aim to support municipal adaptation efforts.

4.1 Principal findings

The case study in Metro Vancouver informed the results of two manuscripts:

4.1.1 Manuscript 1: Is Advocacy a Dirty Word? Planning for Climate Change Adaptation in Canada

The objective of Manuscript 1 was to understand the role of advocacy planning in municipal climate change adaptation. This study addressed three main research questions:

1. How do municipal practitioners feel responsible for climate change adaptation?
2. Do municipal practitioners feel that they should incorporate advocacy planning?
3. How can municipal practitioners be better supported to be advocates?

Interviews with municipal practitioners indicated that practitioners can have conflicting views regarding their responsibility – and their municipality's responsibility – to climate change adaptation. While all municipal practitioners recognized that they were responsible for public interests, tension arose when practitioners felt that the public did not have the same expertise as engineers and scientists, who had a fundamental responsibility to keep them safe. Respondents felt most responsible for adaptation planning that focused on assets controlled by the city, such as water and road infrastructure that had 50-100 lifespans. They also felt responsible for being a repository of climate change information. Many interviewees felt that they were well-positioned to support adaptation policies today that would impact future adaptation planning. However, they felt that they needed additional support from boundary organizations, to stay connected with climate information; higher levels of government, for technical expertise and funding; and industry associations, colleges, and universities to build their confidence to advocate for climate change adaptation within City Hall.

Manuscript 1 led into Manuscript 2 by building on the concept of municipal support and boundary organizations. Manuscript 1 focused on how municipal practitioners could better be supported to advocate for municipal climate change adaptation. Having access to local, climate data projections and adaptation options was stated as important for municipal practitioners to promote adaptation internally. Interviewees acknowledged that boundary organizations were an important tool to connect city staff to adaptation resources. The interviews further explored the concept of boundary organizations to analyze municipalities' current relationships with boundary organizations.

4.1.2 Manuscript 2: The Role of Boundary Organizations: Effective Partnerships to Foster Urban Climate Change Adaptation

The objective of Manuscript 2 was to determine how boundary organizations can better support municipal adaptation from the municipal practitioners' perspective. Two key research questions were as follows:

1. According to municipal practitioners, how do boundary organizations operate at the local level to support municipal adaptation planning?
2. What practical strategies should boundary organizations incorporate to better support municipal adaptation planning?

Within multi-level climate governance, boundary organizations can disseminate knowledge, build capacity, and engage more participants in the adaptation planning process at the local scale. In our research, interviewees believed that boundary organizations can foster organizational change within a municipality to support adaptation planning. Organizational

change is a product of both process-based and culture-based strategies. Interviews with municipal practitioners in Metro Vancouver reveal that boundary organizations can better support change to foster adaptation planning when they provide resources perceived as *credible*, *legitimate*, and *salient*, as well as *action-oriented*.

Our findings operationalized these terms with 'on-the-ground' administrative strategies, which were identified as a need in boundary literature (Parker and Crona 2012). Culture-based strategies to increase credibility identified by interviewees included having affiliated relationships with reputable organizations and having specialized expertise, which prevents mission drift. Process-based strategies identified to increase credibility included providing free support to municipalities to demonstrate potential impact.

Strategies to increase boundary organizations' legitimacy were also process and culture-based. Legitimacy was perceived as a function of collaboration and facilitation. Legitimizing processes were stated to occur when researchers and boundary organizations included municipal practitioners throughout the research process: from the first stage of determining objectives to the stage of framing results. Facilitation strategies were identified to be largely process-based and included facilitating working groups and planning processes among cities, public interests, private interests, and research groups, as well as internally within a municipality. The main culture-based legitimization strategy revealed was the use of boundary organizations to help foster adaptation support within a municipality by communicating with municipal staff across different departments. Some municipal practitioners were frustrated that boundary organizations had limited contact with other City staff.

A boundary organization's resources were perceived as more salient when material was targeted to the needs of municipal planners and councilors, and by providing relevant science in

a timely manner. Strategies listed to increase the usability of science included accessible online platforms, visualizations, webinars, and design charettes.

In addition to credibility, legitimacy, and salience, interviewees stated that boundary organizations must also provide action-oriented support to foster municipal adaptation. Not surprisingly, the two main functions of action-oriented support related to providing funding and process-based tools, such as online adaptation programs.

Overall, this research suggests several key strategies boundary organizations could use to improve their support for municipal adaptation. However, it is critical to recognize that boundary organizations operate within a complex urban climate governance structure; they should be viewed a valuable, *but insufficient,* tool to support local adaptation. Boundary organizations are not a panacea or silver bullet solution.

4.2 Next Steps and Future Research

This thesis explored the perspective of municipal practitioners who are actively involved in climate change adaptation within their municipality. This research is directly relevant to the Canadian planning profession and boundary organizations that work within this space to support municipal adaptation.

This results of Manuscript 1*, Is Advocacy a Dirty Word? Planning for Climate Change Adaptation in Canada*, are relevant to planning educators, the Canadian Institute of Planners (CIP), and elected councillors. More research should explore practical strategies that planning professors could incorporate to empower planners to advocate for social and environmental challenges. As Hodge and Gordon (2014) illustrate, there are currently no detailed frameworks

that outline how planners can navigate the political context of planning. The concept of 'learning from practice' is insufficient for immediate climate action.

While CIP has both a policy statement on climate change and a model standard of practice for climate change, more research is required to investigate how CIP can further foster a culture of climate change adaptation among professional practitioners. What can CIP learn from other associations that have a duty to protect the health and safety of society – such as professional engineering associations and public health associations? How can fellow municipal practitioners support each other in advocating for climate change adaptation?

The relationship between elected officials and municipal practitioners should also be explored to better understand the current political and power dynamics within local government. This thesis primarily focused on the perspective of municipal practitioners. The perspective of elected officials is also critical.

The key findings of Manuscript 2, *The Role of Boundary Organizations: Effective Partnerships to Foster Urban Climate Change Adaptation,* are particularly relevant for boundary organizations and research organizations who aim to support municipal adaptation planning practice. First, more research is required to replicate this case study in other cities that vary in adaptation progress, economic prosperity, social structures, cultural norms, and vulnerability to climate hazards – in both developing and developed country contexts. This paper elicited the perspectives of municipal practitioners and their perceived relations with boundary organizations when planning for adaptation. More research is required to better understand the perspectives of boundary organizations and the research organizations they are affiliated with. Do these actors agree with the strategies municipal practitioners proposed to better support municipal adaptation? Are there other strategies that they have found to be fruitful? Additionally, there

many other actors that operate across scales to support municipal adaptation – including higher levels of government, civil society, First Nation groups, and the private sector. How do boundary organizations work with these actors to obtain, generate, and disseminate climate information and resources?

Manuscript 2 also revealed several tensions within boundary organization management. The main tension revolved around the concept of neutrality. Participants stated that a boundary organization's neutrality was a key strength because it enabled the boundary organization to facilitate networking among actors with opposing interests. Many boundary organizations are affiliated with university or research institutions that aim to produce 'neutral' and 'objective' science. However, many boundary organizations exist because they aim to influence municipal adaptation, and therefore they do not necessarily have 'neutral' agendas. Further research should investigate the role of neutrality in climate change research, knowledge dissemination, and boundary work. Do boundary organizations need to remain neutral to effectively support municipal adaptation? Is it unethical to maintain neutrality when the public interest is at stake? How can boundary organizations serve as facilitators and collaborators in the absence of neutrality?

This thesis provides the foundation for a better understanding of the role of advocacy planning and the role of boundary organizations in municipal adaptation planning. It is hoped that the results are able to inform practice and contribute to research to further support municipal climate change adaptation.

Appendices

Appendix A: Methodology Addendum

This research investigated two critical strategies municipal practitioners could use to advance climate change adaptation: advocacy planning and boundary organizations. Qualitative interviews were conducted in Metro Vancouver with municipal practitioners to investigate the role of advocacy planning as well as the use of boundary organizations to support local adaptation planning.

Participants were purposely selected (Creswell, 2014) based on two criteria: (1) involvement in adaptation planning processes and (2) employment, or previous employment, at a municipality in Metro Vancouver. We identified 22 municipal practitioners that fit these criteria by consulting with local academic experts, reviewing government websites, and using a snowballing interview technique (Charmaz, 2006). Interviews took place over 30-60 minutes in a semi-structured format face-to-face or by phone. The interviewees shared their views and validated findings from academic and grey literature.

Interviews were conducted with a diverse group of practitioners across Metro Vancouver until findings became saturated at 13 interviews. Participants were from Bowen Island, the City of Vancouver, City of North Vancouver, The Corporation of Delta, District of North Vancouver, Port Coquitlam, Surrey, the Township of Langley (see Figure 4.1). These cities are home to 71% of Metro Vancouver's population. Two staff at the regional government of Metro Vancouver were also interviewed to determine if findings were consistent across the region. The raw data was collected, anonymized, and transcribed. NVivo, a qualitiative analysis software, was used to determine trends. Key trends were interpreted and compared with climate change adaptation and

urban planning literature.

Figure 4.1 Municipalities in Metro Vancouver that participated in interviews

Credible qualitative studies, similar to credible quantitative studies, require reliability and validity. However, the concepts of research reliability and validity are implored differently in qualitative and quantitative research. *Qualitative validity* refers to the researcher using specific procedures to check the accuracy of the interview findings. *Qualitative reliability* refers to the researcher using an approach that is consistent across different research projects (Creswell, 2014).

In contrast to quantitative validity, qualitative validity does not present findings in terms of statistical significance. Instead, qualitative validity relates to the *trustworthiness*, *authenticity*, and *credibility* (Creswell, 2014; Creswell & Miller, 2000) of the researcher, research techniques,

and interviewee. Creswell (2014) presented several validity strategies to enhance the accuracy of research findings, including triangulation; member checking; rich, think descriptions; bias clarification; and an external auditor to review the project. This project used triangulation to compare interview comments with data from other sources, specifically municipal adaptation documents. Member checking refers to taking themes and key findings back to interviewees for their input. An adapted form of member checking was used during the interview. Interview comments were repeated back and clarified during the interview process to improve the researcher's interpretation of data. Finally, full quotations of interviewee comments were included as much as possible in the final manuscripts to preserve the intended meaning of the comments. This also helped to reduce researcher bias.

Qualitative reliability is established when a consistent interview and data analysis process is used. This research project used well-established interview techniques that are consistent with other municipal adaptation research conducted in Metro Vancouver (Burch, 2010). Each interview followed the same series of open-ended questions. Data was coded by one individual to ensure consistency across interview transcripts.

It is important to note that qualitative interviews have several limitations. Creswell (2014) stated that the insight is indirect and can be biased towards the participant's personal views; not all participants will be similarly perceptive and articulate; and the researcher's positionality might influence the interviewees responses and their interpretation. Furthermore, case study findings are generally difficult to generalize. However, the benefit of good qualitative research is not its generalizability, it is its particularity (Greene & Caracelli, 1997). Therefore, like similar adaptation case studies, such as those conducted by Bauer et al. (2013), the results will contribute to the literature with exploratory findings that critique conventional adaptation

planning and provide initial insight into how partnerships could better foster adaptation at the city scale. My positionality as a researcher was that I was a young, female student that believed that municipal practitioners should be responsible for climate change adaptation. Interviewees had the potential to underestimate the project's credibility and/or be led down to falsely agreeing that adaptation was important. I tried to reduce this bias by connecting this research project with the wider research at the University of Waterloo and through the international team Coastal Cities at Risk. Additionally, I never explicitly stated my own views on adaptation and used active listening techniques to validate the interviewees responses.

Appendix B: Email Contact Script and Recruitment Letter

Dear X

My name is Alex Graham and I am a master's student at the University of Waterloo. I am inviting you to participate in a climate change adaptation research project by partaking in an interview that will take approximately 45 minutes. I have been referred to you because of your unique understanding and perspective of climate change adaptation in Metro Vancouver. **I would love the opportunity to interview you.**

My study is called The Role of Boundary Organizations in Climate Change Adaptation and I am investigating how boundary organizations, such as ICLEI Canada and the Fraser Basin Council, can effectively connect policy makers with climate science to facilitate climate change adaptation. This project is funded by the Social Science and Humanities Research Council and is part of a larger project Coastal Cities at Risk that is conducting adaptation research in Vancouver, Manila, Bangkok, and Lagos.

If you are able to participate please indicate your availability in between X-X.

I have attached a formal invitation to participate in my research. If you have any questions please connect with me over email or phone at 647 622 6963.

Thank you in advance.

Sincerely,

Alexandra Graham, HBA
Candidate for MES, Urban Planning
University of Waterloo
A29graha@uwaterloo.ca
647 622 6963

Hello,

My name is Alex Graham and I am a master's student at the University of Waterloo. I am inviting you to participate in a climate change adaptation research project by partaking in an interview that will take approximately 45 minutes. I believe you have a unique understanding and perspective of climate change adaptation in Metro Vancouver.

My study is called *The Role of Boundary Organizations in Climate Change Adaptation* and I am investigating how boundary organizations, such as the Fraser Basin Council and ICLEI Canada, can effectively connect policy makers with climate science to facilitate climate change adaptation. This project is funded by the Social Science and Humanities Research Council and is part of a larger project Coastal Cities at Risk that is conducting adaptation research in Vancouver, Manila, Bangkok, and Lagos.

If you are able to participate please indicate your availability in between July 24th – August 28th.

All information you provide through your participation in this study will be kept confidential. Your consent to participate in this study will not be shared with your employer. Furthermore, you will not be identified in any report or publication based on this research. We do not anticipate risks to participants in this study. The data collected through this study will be kept in a secure location for a period of seven years. Participants may withdraw agreement to participate at anytime during the study without reprisal by opting out of the interview or sending a follow up message.

If you have any questions about this study, or would like additional information, please contact me at a29graha@uwaterloo.ca or 647 622 6963.

I would like to assure you that this study has been reviewed and received ethics clearance by the University of Waterloo Research Ethics Committee. However, the final decision about participation is yours and you are able to withdraw at any time during the survey. Should you have any comments or concerns about your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics, University of Waterloo at 1-519-888-4567, Ext. 36005 or maureen.nummelin@uwaterloo.ca.

Again, If you are able to participate please indicate your availability in between July 24th – August 28th.

Thank you in advance for your co-operation.

Sincerely,

Alexandra Graham, HBA
Candidate for MES, Urban Planning
University of Waterloo
A29graha@uwaterloo.ca
647 622 6963

Appendix C: Information and Consent Letter and Waiver

UNIVERSITY OF WATERLOO

Information and Consent Form

This study is called *The Role of Boundary Organizations in Climate Change Adaptation* and I am investigating how boundary organizations, such as ICLEI Canada and the Fraser Basin Council, can effectively connect policy makers with climate science to facilitate climate change adaptation. This project is funded by the Social Science and Humanities Research Council and is part of a larger project Coastal Cities at Risk that is conducting adaptation research in Vancouver, Manila, Bangkok, and Lagos.

All information you provide through your participation in this study will be kept confidential. Furthermore, you will not be identified in any report or publication based on this research. We do not anticipate risks to participants in this study. The data collected through this study will be kept in a secure location for a period of seven years. Participants may withdraw agreement to participate at anytime during the study without reprisal by opting out of the interview or sending a follow up message.

If you have any questions about this study, or would like additional information, please contact me at a29graha@uwaterloo.ca or 647 622 6963. This project is part of my thesis, under the supervision of Dr. Carrie Mitchell. She can be contacted at carrie.mitchell@uwaterloo.ca or 519-888-4567 ext. 33027. There are no known or anticipated risks to you as a participant in this study.

I would like to assure you that this study has been reviewed and received ethics clearance by the University of Waterloo Research Ethics Committee. However, the final decision about participation is yours and you are able to withdraw at any time during the survey. Should you have any comments or concerns about your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics, University of Waterloo at 1-519-888-4567, Ext. 36005 or maureen.nummelin@uwaterloo.ca.

Sincerely,

Alexandra Graham
Candidate for MES, Planning
University of Waterloo
A29graha@uwaterloo.ca
647 622 6963

CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

I have read the information presented in the information letter about a study being conducted by Alexandra Graham of the Department of Environment at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

519-888-4567 | uwaterloo.ca | 200 UNIVERSITY AVENUE WEST, WATERLOO, ON, CANADA N2L 3G1

UNIVERSITY OF WATERLOO

I am aware that excerpts from the interview may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact the Director, Office of Research Ethics at 519-888-4567 ext. 36005.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

☐YES ☐NO

I agree to have my interview audio recorded.

☐YES ☐NO

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

☐YES ☐NO

Do you wish to receive a summary of research findings?

☐YES ☐NO

Do you provide consent for the researcher to use the information obtained in this interview in part of an additional study called Adaptation Information: Development of a system to enhance and manage information on adaptation options arising from the International Development Research Centre (IDRC) Climate Change and Water (CWW) Program. This project has also received full ethics approval and you will not be identified in any resulting publication.

☐YES ☐NO

Participant Name: _____ (Please print)

Participant Signature: _____

Date: _____

519-888-4567 | uwaterloo.ca | 200 UNIVERSITY AVENUE WEST, WATERLOO, ON, CANADA N2L 3G1

Appendix D: Interview Script

Municipal Staff Questions

First review information and consent form, sign waiver, and begin audio recording.

My research is focusing on the information needs of municipal decision makers and the role of boundary organizations. The term 'boundary organization' has emerged to label the growing number of intermediary organizations that connect science to practice. In Metro Vancouver several examples include… (1) ICLEI Canada – which helped with the adaptation planning process, (2) the Pacific Institute for Climate Solutions – which provides tools for impact assessment, and (3) Fraser Basin Council which is helping coordinate a regional approach for flood management. Please let me know if you need any more clarification on this term at any point. When I refer to the term climate change in Metro Vancouver, I mean both gradual impacts, such as sea level rise, increased precipitation, and increasing temperatures, and also abrupt impacts such as flooding, extreme heat waves, and forest fires.

Advocacy

1. What is your role – and the role of the municipal government – in climate change adaptation?
2. What do you think it should be?
3. Should municipal practitioners advocate for climate change adaptation? *Why? Why not?*

Climate Science

4. How does your organization incorporate climate science and information into planning and policy making?
5. Can you speak about your experience accessing climate adaptation information?
    - *Prompts – Where do you seek information, Challenges with journals, relationships with other organizations or researchers? Benefits?*.

Role of Boundary Organizations

6. What are some of the benefits of working with a boundary organization to incorporate science into planning?
7. Which organizations have been most influential in terms of facilitating adaptation planning? How come? Can you speak about your relationship with ICLEI, Fraser Basin Council, PCICs, ACT?
8. Can you speak about some of the challenges working with boundary organizations?

What is required of boundary organizations?

9. How could boundary organizations better support municipal actors in climate adaptation planning?
10. Boundary organizations and municipal partners can set up their relationship in many different ways (for example funding through the province, in-kind support, research arrangements, etc). Can you speak about what relationships work best?

Boundary Organization Alternatives – Online Database

11. Many organizations are looking for the best ways to disseminate adaptation information. For example, the IDRC has hundreds of funded adaptation projects and is trying to figure out the best way to share the findings from the project. What do you think would be the best way for your municipality to access this information?
    - *Prompts – online database, conference, seminar, highlight reel, video, mentorship or boundary organizations?*

Best practices

12. I would like my research to help guide boundary organizations as whole better service municipal actors in climate adaptation… what should I include on this list of best practices?
    - *Prompts: criteria, needs, relationships, joint knowledge production, accountability to both sides, facilitating decision making*

Conclusion

13. What are the key boundary organizations that work in Metro Vancouver that you think would be beneficial to interview?
14. How many staff work on climate adaptation at the City of Surrey? Is there anyone else you think I should speak with at Surrey? Are there staff members at other municipalities that you think I should speak with?
15. Is there anything else you would like to add?

Appendix E: Research Assistant Confidentiality Form

CONFIDENTIALITY STATEMENT

I understand that as a transcriber for the study *The Role of Boundary Organizations in Climate Change Adaptation* being conducted by Ms. Alexandra Graham of the Department of Environment, University of Waterloo under the supervision of Professor Carrie Mitchell, I am privy to confidential information. I agree to keep all data collected during this study confidential and will not reveal it to anyone outside the research team.

Name: _____ Signature: _____

Date: _____ Witness Signature: _____

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