IMPLEMENTATION OF CLIMATE CHANGE ADAPTATION IN SMALL MUNICIPALITIES IN NEWFOUNDLAND: PROCESS AND BARRIERS

By

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Abstract

The impacts of climate change are already manifesting, and municipalities (both small and large) across the globe are attesting to this fact based on the increase and frequent changes in precipitation and temperatures, causing flooding, and storms in their locality. As a result, municipalities are implementing a myriad of actions to adapt to such impacts. Using a case study approach, the study used three small-size municipalities (population under 10,000) in western Newfoundland to ascertain the process they follow to implement adaptation measures, the role of multi-level governance in climate change adaptation and barriers they encounter to adapt to climate change.

The findings from the study identified climate impacts in these municipalities, which included flooding, riverbank erosion and coastal erosion. The study found that climate impacts experienced differ among municipalities and so were the measures taken to minimise them. The municipalities under study did not have municipal adaptation plans to provide defined processes or steps to adapt to climate change. These municipalities instead used reactive methods to adapt to climate change. Regarding the role of multi-level governance, the study found that municipalities had direct relationships with the provincial government and that these relationships were most often perceived to hinder municipalities' attempts to implement projects of high priority in the community. Some of the barriers identified in this study include the lack of funding for municipal adaptation projects, inadequate human resources to take on climate adaptation responsibilities and a lack of awareness and political interest. To overcome these barriers recommendations suggested included streamlining access to funding and intensifying public participation and education.

Keywords: climate change, climate change adaptation, multi-level governance, partnership

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List of Abbreviations

ICLEI	International Council for Local Environmental Initiatives
IPCC	Intergovernmental Panel on Climate Change
MLG	multi-level governance
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
USA	United States of America
NL	Newfoundland and Labrador

Chapter 1: Introduction

1.0 Introduction

The climate is changing. Its impacts are already manifesting globally, and the Newfoundland and Labrador province in Canada is not an exception (Bush, Lacroix, Lemmen, and Warren, 2008; International Panel on Climate Change-IPCC, 2007). This is evident in the increase and frequent changes in precipitation and temperatures, causing more flooding, heatwaves, landslides, sea-level rise, loss of biodiversity, storms, and many other impacts (Dale, Hayes, & Hughes, 2016; IPCC, 2007; Picketts, 2002; Easterling et al., 2000;). This change is due to several factors; research indicates that natural variations over the years have contributed to this change; however, increased greenhouse gas emissions have aggravated the impacts of such change (Richardson, 2010). This posits that the change may further pose a severe threat to national development in many uncertain ways unless strategic and systematic mechanisms and frameworks are put in place to ensure resilience in development and reduce vulnerability (IPCC, 2007). Therefore, in the quest to minimize the impact of climate change, there has been a myriad of emergent adaptation development policies. This is evident at both the international and national levels. For instance, at the international level, a variety of adaptation finance mechanisms have been established through the United Nation Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, including the Global Environment Facility Trust Fund, the Special Climate Change Fund, the Least Developed Countries Fund, and the Adaptation Fund (Measham, Preston, Smith, Brooke, Gorddard, Withycombe, & Morrison, 2011; Robinson, & Gore, 2005). These initiatives trickle down to other government levels, such as the local governments to access financial and technical resources to advance climate adaptation.

One may ask, why adaptation? The UNFCCC presents two climate change responses: climate mitigation – which is usually focused on reducing greenhouse gas emissions and climate adaptation – which is focused on actions to help adjust to climate change impacts. Both adaptation and mitigation are essential for reducing the adverse impact of climate change (IPCC, 2007 as cited in Meehl et al., 2007; Klein et al., 2007). The fourth assessment report of the IPCC affirms this by stating that neither mitigation nor adaptation strategies alone can prevent climate change impacts; however, adaptation serves as a complement to mitigation in reducing the damages that cannot be avoided from climate change (Bush et al., 2008). To minimize municipalities' vulnerability to the impacts of climate change and increase their adaptive capacity – which usually refers to a system's ability to effectively cope with the effects of climate change, adaptation has now gained policy priority in both local level planning and multi-level governance. Corfee-Morlot et al. (2009) established that developing the right policies at the local level either regional or municipal has the propensity to regulate greenhouse gas emissions of the built environment whilst providing durable infrastructure that can withstand the impacts of the changing climate.

1.1 Problem statement

Canada is experiencing rapid change in its climate, and thus actions are required by all government levels to advance climate adaptation. However, activities at the local level may be regarded as most important because it is that level where many of the impacts of climate change are felt directly (Richardson, 2010). It is against this backdrop that contemporary adaptation planning and policy have been focused on municipal governments. The overall purpose of encouraging municipal adaptation planning is to reduce vulnerability to climate risks and effects through planning ahead proactively. The attention given to local adaptation planning and policy highlights the relevance of local government for adaptation; however, the ultimate role concerning

the practical implementation of adaptation policies and measures are dependent upon different factors like other levels of government and inter-city support networks such as the International Council for Local Environmental Initiatives (ICLEI) and other non-government organizations (Oulahen et al., 2018; Measham et al., 2011). In 2016, the Newfoundland and Labrador (NL) province adopted the Pan-Canadian Framework on Clean Growth and Climate Change like other provinces in Canada. This framework presented a collaborative national approach to addressing climate change in the ten provinces (Government of Newfoundland and Labrador, 2019). The province is much concerned about the issue of climate change adaptation due to the increasingly warmer temperatures, high sea-level rise, coastal and riverbank erosion, infrastructure damage, and flooding experienced by the municipalities in the province (Government of Newfoundland and Labrador, 2019; Finnis, 2013; Bauer et al., 2010). This study, therefore, focuses on selected small municipalities in the province regarding their challenges towards implementing climate adaptation. Small municipalities according to this study are defined as municipalities with population less than 10,000 people, which falls within the range for small population centers set by Statistics Canada (2017) see section 3.2 for detailed information.

Research indicates that, even though strategic measures have been put in place to minimize greenhouse gas emissions, some amount of climate change is inevitable and will have significant (economic, social, and environmental) impacts on Canadian communities (IPCC, 2019; Richardson, 2010). To reduce the adverse effects of this unavoidable change and take advantage of new opportunities it may bring (for instance water crises as a result of climate change may provide opportunities for cities to invest in more resilient water infrastructure), cities need to adapt (Richardson, 2010). The primary concern in contemporary times has focused on the unexpected variability in climate and how communities will adapt to such changes, making the municipal level

(local planning body) an important platform to implement adaptation strategies, where direct benefit and results will be achieved (NRCan, 2004).

The emerging discourse on adaptation has inspired and motivated many scholars to explore many dimensions of climate adaptation, including barriers to adaptation and the process of integrating adaptation into planning at all levels of government (Biesbroek, 2014). Existing literature recognizes barriers to climate change adaptation ranging from international policy debates to the national and even regional levels. The global policy debates, for instance, have mostly focused on identifying barriers among sensitive groups that are greatly affected by the impacts of climate change (Oxfam, 2011). An example at the national level is the Australian government tasking the Productivity Commission with assessing policy and regulatory deficiencies affecting effective climate adaptation as well as identifying prospective measures that can be used to increase community participation and thus enhance effective adaptation (Productivity Commission, 2012). At the intergovernmental level, Europe also launched an adaptation strategy in 2013 to identify some barriers that hinder its member states to adapt to climate change (EEA 2013). Additionally, the member states themselves have identified individual barriers to adaptation and are putting more effort to research ways to overcome such barriers. Of course, barriers to climate adaptation have gained prominence at the local/municipal and regional level because adaptation is primarily developed and implemented in those levels of government (ESPACE, 2005). Overall, governments at all levels worldwide are beginning to engage other actors and stakeholders to implement climate adaptation and identify adaptation barriers (Barnett, Waters, Pendergast, and Puleston, 2013).

Municipal climate adaptation action is most often known to be a combination product implemented by public, private, and civil service actors operating in the jurisdiction and even

across other regions (Graham & Mitchell, 2016). One major aspect of multi-level governance is the numerous funding streams associated with it (Valdivieso, Andersson, & Villena-Roldán, 2017). Therefore, Valdivieso et al. (2017) proposes that investment decisions increase with multi-level governance, this is because, when municipalities coordinate and communicate with multiple actors on different levels of governance or private sectors, they can invest in a variety of local development areas because they have the financial capacity. Such ability to invest in climate change adaptation at the municipal level can contribute to improved financial status of municipalities. Ryan (2015) opines that larger municipalities can manage climate adaptation elements using their resources, capacities, knowledge, and information. However, small municipalities suffer from resource scarcity, and therefore need to rely more on multi-level governance, which may still be insufficient to meet the needs of such municipalities (Ryan, 2015) due to the fact few private businesses and corporations exist in small municipalities.

As stated, a lot of research has been conducted on adaptation barriers; however, emerging scholarship has focused primarily on larger municipalities, whose resource base, both human and financial assets, tends to be substantial (e.g., Picketts, Curry, Déry, & Cohen, 2013; Burch, 2010). Scholars have not made much progress beyond simply studying adaptation barriers in small or vulnerable municipalities. There has been little to no research on how small municipalities are adapting to climate change impacts, especially in the Canadian context (Bausch & Koziol, 2020). However, most of these small municipalities are constrained, which undermines their capacity to adopt sustainable adaptation strategies to limit their vulnerability and exposure to climate change impacts (Vogel, Henstra, & McBean, 2020). It is important to note that understanding the nature and emergence of adaptation barriers at the municipal level is vital in providing meaningful

policies to overcome such barriers and promote progression in the adaptation process (Clar, Prutsch, and Steurer, 2013).

1.2 Research objectives and questions

The previous section established that the planning and implementation of climate change adaptation is not a barrier-free process. It also gives instances where international, national, regions, and states have taken steps to identify some of these barriers in order to reform policies, regulations, or behaviors to overcome such barriers. More research is needed in climate change adaptation since most scholarly debates have focused on the international and national levels, as well as larger municipalities or metropolitan areas; knowledge of what these barriers actually are in small municipalities has not been broadly researched. Therefore, the overall objective of this thesis is to better understand the barriers to implementing climate change adaptation in small municipalities in Newfoundland and Labrador. Based on this objective, four research questions were formulated to give more insight into 'actually-existing' adaptation policy and its implementation in Newfoundland's small municipalities (see section 3.3 for a detailed description of study areas). The questions are listed below.

- What are the processes that small municipalities in NL follow to implement climate change adaptation?
- What are the challenges these municipalities face in implementing adaptation?
- What role does multi-level governance play in municipal adaptation in NL?
- How can small municipalities in NL address adaptation implementation challenges?

Pursuing the above questions through a case-study research approach will serve as an opportunity to provide more understanding and knowledge of climate change adaptation in small municipalities, while acknowledging the unique context of each municipality.

1.3 Organization of the thesis

The thesis is structured into six chapters. The first chapter is the introduction. It gives a general overview of the subject matter. This chapter introduces the existing problems and the questions that need to be answered at the end of the thesis. Chapter 2 presents a literature review focusing on municipal climate change adaptation, multi-level governance, secondary data on barriers to climate change adaptation, and other relevant topics. The third chapter describes in detail the research design and methodology used in this study. Chapter 4 presents the results and detailed analysis of the results. The chapter aims at answering the four research questions outlined in section 1.2. Lastly, Chapter 5 presents broader policy recommendations and a general conclusion.

Chapter 2: Literature review

2.0 Introduction

This chapter discusses the key ideas, concepts, and opinions guiding the research work. It presents a general overview of climate change, with particular focus on adaptation. It goes further to discuss literature on small-medium sized municipalities and adaptation at the local or municipal level of government. The chapter further explores the multi-level governance (MLG) concept in the climate change discourse. It presents literature on global MLG, the Canadian context regarding MLG, and adaptation implementation capacity of municipalities. Discussions on cross-sector partnerships then follow this, and lastly, the chapter explores the literature on the barriers to implementing municipal climate adaptation.

2.1 Climate change

Climate change as an ecosystem concern has seen great development over the past 25 years. It was a topic discussed primarily by natural scientists; however, it has evolved to be amongst the top priority issue on the global policy agenda (Bernauer, 2013). In the history of climate change, natural scientists have understood climate change to have significant impacts on biodiversity, which gave climate biologists the opportunity to work on how to reduce the impacts. However, over the years, the focus has shifted to the importance or relevance of climate policy towards controlling climate change. Thus, the emergence of climate change policies to support scientists on combating the impacts associated with climate change (Hannah, 2011). The UNFCCC, which was signed at the United Nations Conference on Environment and Development in 1992, is the international policy body for providing rules and policies to protect against harmful human interference in the climate system (Deangelo & Harvey, 1998). The first set of policies to

implement the UNFCCC was the Kyoto Protocol, which entered into effect in February 2005 (Deangelo & Harvey, 1998). The Kyoto Protocol sought to reduce greenhouse gas levels by setting emission reduction targets for about 37 industrialized countries (Bernauer, 2013; Hannah, 2011). The increased industrialization of many Western countries has resulted in high global temperatures (Bulkeley & Kern, 2006), and hence immediate action was required to limit global temperatures.

The Canadian government announced its withdrawal from the Kyoto Protocol in December 2011 (Environment and Climate Change Canada, 2013). The Canadian government, however, signed onto the 2016 Paris Agreement, a new agreement adopted by the UNFCCC in 2015 to govern emission reductions and ultimately limit global temperature rise (Environment and Climate Change Canada, 2020; Stephenson, 2018). The agreement also encourages countries to increase and strengthen adaptation efforts to reduce vulnerability and build resilience to climate change (Environment and Climate Change Canada, 2020). Although the Kyoto Protocol was the first legal agreement under the UNFCCC, the Paris Agreement saw a greater degree of acceptance, with many more nations signing on (Stephenson, 2018).

In the environmental and development discourse, climate change has been defined by many stakeholders. The UNFCCC (1992, p. 7) defined climate change as "change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." However, the IPCC definition of climate change differs slightly from that of the UNFCCC. It defines climate change as changes in climate due to either natural variability or human activities (UNFCCC, 2011). The Department of Environment and Climate Change Canada defines climate change as "a long-term shift in weather conditions identified by changes in temperature, precipitation, winds, and other indicators. Climate change can involve both changes

in average conditions and changes in variability, including, for example, extreme events" (Environment and Climate Change Canada, 2019). Although all the above explanation are true, for the purpose of this study, climate change is defined as long-term changes in weather caused by human activities and nonhuman or natural forces.

The main human activity that causes climate change is the burning of fossil fuels. The burning of fossil fuels produces methane and carbon dioxide, which are classified as greenhouse gases because they produce greenhouse effects, which make the earth warmer (Environment and Climate Change Canada, 2019). According to the IPCC (2014), carbon dioxide is seen as the most greenhouse gas produced by humanity. The global atmospheric concentration of carbon dioxide has increased over time and keeps rising annually (IPCC, 2014). When these greenhouse gases are released into the atmosphere, they trap heat, causing the earth's surface temperature to increase and resulting in extreme weather conditions, sea-level rise, biosphere consequences, and natural disasters (Bernauer, 2013). Climate change has now been tagged as the 'negative Anthropocene' due to the negative effect of human activities on the earth (Rahman, 2013). Impacts caused by human activities on the earth's climate started in the early 19th century when the industrial revolution precipitated the release of about 2.3 trillion metric tons of carbon dioxide into the atmosphere (Fox, 2020; Bernauer, 2013). Since the middle of the 20th century, anthropogenic activities had contributed substantially to the rising surface temperatures (IPCC, 2014). Although the history of climate change was not centered on human activities at this point, impacts due to anthropogenic influences were undoubtedly evident. Now, the two primary human activities that have considerably impacted the earth are land use and industrialization (Chen, Chen, and Fath, 2014; IPCC, 2014; Bernauer, 2013). Other activities include problematic agricultural practices, overharvesting of species, deforestation, destruction of natural habitats, etc. (Hansen, Sato, &

Ruedy, 2012). The IPCC (2014) suggests that there may be many drivers contributing to high emissions of GHGs; however, high population and economic growth are the primary ones. According to the Fifth Assessment Report from the IPCC, changes in the climate will cause a high rise in sea levels, extremely warm temperatures, extremely cold temperatures, ocean acidification, high frequency in precipitation, and more frequent heatwaves (IPCC, 2014; Hansen et al., 2012; Karl & Trenberth, 2003). Hansen et al. (2012) posit that climate change will significantly impact the summer season especially in countries that have the winter, fall and summer season and those tropical countries with summer all year round will experience extreme hotter days. The summer season is the season of high biological productivity. This implies that summer would be prolonged as a result of the extreme warmer temperatures. These temperatures will extend into the fall season, which may have some positive and negative effects. For example, some countries require colder or freezing temperatures to reduce the outbreaks of post-winter pests and diseases. For instance, Western Canada has experienced an outbreak of dendroctonus ponderosae known as pine bark beetles due to warmer winters (Hansen et al., 2012). Such countries will be affected negatively by prolonged summers. However, prolonged summers also affect agricultural activities which may be on a positive side (Hansen et al., 2012).

Climate change has become an urgent topic internationally (FCM & ICLEI, 2016), as many countries and cities have come to the realization of the challenges of economic activity that is both carbon-intensive and unsustainable (Dulal & Akbar, 2013). It has been observed that the ongoing emission of greenhouse gases will further increase global warming and impact the earth and its natural systems, with some effects being permanent (IPCC, 2014). Human beings are both vulnerable to and responsible for climate change (IPCC, 2014). However, climate impacts affect people differently based on geographical location and human activities, with some people being

more disadvantaged than others (IPCC, 2014). As stated above, recent climate change is mainly a result of anthropogenic activities. Even if these activities were to halt, past and present emissions would continue to impact the earth (Bernauer, 2013; Karl &Trenberth, 2003). This indicates that focus should be geared towards adaptation activities alongside mitigation that will enable countries and cities to continue their activities despite the climate change impacts.

2.1.1 Climate change adaptation

Recent studies, notably the IPCC reports, indicate that climate change will mean severe impacts on the earth's physical and biological systems, which will affect social and economic structures (IPCC, 2007). Probing further, Aalst (2006) posits that climate change is likely to become increasingly hostile with more irreversible consequences. Climate change will persist for many hundreds, even thousands, of years, irrespective of the success of strategies and global initiatives to reduce greenhouse gas emissions (IPCC, 2018; Lemmen et al., 2008). This persistence is due not only to ineffective mitigation efforts in the past but also to the relatively long half-life of carbon dioxide and methane in the atmosphere from emissions from decades ago. Moreover, Klein et al. (2007) state that implementing the most effective mitigation strategies alone cannot prevent further climate change impacts in the years to come, thus making adaptation unavoidable.

Although reducing the anthropogenic contribution to greenhouse gas concentrations will, in a way, lessen the rate and magnitude of climate change impacts, scientists and researchers have observed that mitigation efforts alone are not adequate to achieve a substantial rate of impact reduction (Rosenzweig & Solecki, 2010). This can be attributed to the fact that climate systems are complex and interactive; they are "systems consisting of five major components: the

atmosphere, the hydrosphere, the cryosphere, the land surface, and the biosphere, forced or influenced by various external forcing mechanisms, the most important of which is the Sun" (Baede, Ahlonsou, Ding and Schimel, 2001, p. 87). Over the years, these systems have not responded to mitigation measures due to previously existing greenhouse gas effects, which can partly be attributed to insufficient mitigation measures. It is against this backdrop that adaptation has gained tremendous attention in contemporary planning because adaptation measures are meant to minimize the consequences of impacts that mitigation measures could not reduce or prevent (Rosenzweig & Solecki, 2010). Countries across the globe now recognize the importance of adaptation. Most industrialized countries have now added adaptation to their political agenda, at both national and local levels (Dannevig, Rauken, & Hovelsrud, 2012). The value of curbing the adverse effects of climate change is gaining popularity and recognition within the policy-making and scientific spheres (Munaretto, Siciliano, & Turvani, 2014.).

Adaptation has been defined by many authors, scientists, and researchers; however, all these definitions involve one keyword: 'adjustment'' (IPCC, 2007a; Smit & Pilifosova, 2003; Klein, 2000). Thus, adaptation is all about making adjustments in the environmental, social, and economic systems in response to the uncertain nature of climate change impacts. Such adjustments can include various changes to policies, plans, processes and practices to minimize or offset potential effects, or to take advantage of opportunities associated with such changes (Smit et al. 2003). Therefore, climate change adaptation refers to the various activities that minimize the adverse impact of climate change while taking advantage of new opportunities presented by these changes (Richardson, 2010). Nelson et al., (2007, p. 395) also describe adaptation as a

> decision-making process and the set of actions undertaken to maintain the capacity to deal with future change or perturbations to a social-ecological system without undergoing significant changes in function, structural identity, or feedbacks of that system while maintaining the option to develop.

The most widely recognized, accepted, and used definition of adaptation is the IPCC's, which states that

> adaptation is an adjustment in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. This term refers to changes in processes, practices, or structures to moderate or offset potential damages or to take advantage of opportunities associated with climate changes (IPCC, 2001 p. 982).

Both definitions are relevant to the study as they present adaptation to be a decision-making process to guide planning and designing of systems that will be resilient to the impacts of climate change. It can be deduced from the definitions that adaptation is envisioned to minimize climate change costs and damages.

Adapting to climate change comprises a myriad of actions, usually in the form of institutional, educational, legal, technical, and behavioral activities entrenched within sectoral or divisional plans and initiatives like transportation planning, agriculture policy, waste management planning, etc. (Munaretto et al., 2014). Climate change adaptation involves building adaptive capacity in organizations, individuals, communities, and sectors, as well as transforming that capacity to action through adjusting to changes and contributing to implementing adaptation decisions (see Munaretto et al., 2014; Nelson et al. 2007; Walker et al. 2004). Adaptive capacity can be defined as the necessary preconditions which can be in the form of skills, resources, and knowledge required for adaptation (Wall & Marzall, 2006; Grothmann & Patt, 2005). Such capacity is influenced by natural, economic, and human resources; technology; social networks; infrastructure; and institutions (IPCC, 2007; Nelson et al., 2007; Füssel and Klein 2006; Grothmann, & Patt, 2005).

There exist different ways of practicing adaptation. The IPCC Third Assessment Report presents different ways of categorizing adaptation and distinguishing between the various types of

adaptation: anticipatory/proactive and reactive adaptation, autonomous and planned adaptation, and private and public adaptation (Bosello, Carraro, & De Cian, 2012). Reactive adaptation occurs in response to climate impacts, and proactive adaptation occurs before climate change impacts are observed (Füssel, 2007, McCarthy et al., 2001). In most cases, proactive adaptations will lower long-term costs and be more effective than reactive adaptations (Grothmann & Patt, 2005). Therefore, government or private individuals should always weigh the two and make informed decisions that will have better results now and in the future (Bejjani, Tan, & Egner, 2020; Brown, Naylor, & Quinn, 2017). The report defines autonomous adaptation as "adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems" and planned adaptation as "adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve the desired state" (McCarthy et al. 2001, p. 982). There may be instances where government interventions will not be needed to adapt, but the market or welfare effects will cause individuals to adapt. For example, economic effects on farm produce due to climate change can cause farmers to make some adaptations in terms of time and type of cultivation (Bosello et al., 2012). Another distinction is between public and private adaptation. Public adaptation is adaptation undertaken by the government based on collective needs and aspirations (McCarthy et al. 2001). In contrast, private adaptation is undertaken by households, individuals, or groups based on organization goals and interests or individual interests (McCarthy et al. 2001). From the above-explained types of adaptation, it can be inferred that it takes several factors to decide the type of adaptation to implement. Bosello, Carraro, & De Cian (2012) conceptualize adaptation decisions along three dimensions. The first dimension is the *subject* of adaptation. Adaptation only occurs as a result of changes in either the ecological system or the social and economic system. Probing further, they

explain that when changes occur in the ecological system, organisms and species will be involved; and when changes occur in the social and economic system, individuals, public actors, or private actors (or a combination) will be involved. The *object* of adaptation is their second dimension—it focuses on what to adapt to. For instance, are individuals or species adapting to changes in the average weather conditions or extreme climate variability? The third dimension refers to how adaptation occurs. This dimension pays attention to resources, approaches, and results (see McCarthy et al. 2001) as well as evaluating performance for better adaptation.

2.1.2 Municipal (local) climate change adaptation and planning

Recent studies on climate change have recognized the importance of adaptation as a conventional approach for addressing climate vulnerability (Carlsson-Kanyama, Carlsen, & Dreborg, 2013; Measham et al., 2011). Attention in contemporary climate research has now shifted towards adaptation, unlike previously when the focus was much more on mitigation (Füssell, 2007). The concept of adaptation has now been accepted by communities across Canada and the globe, and most of these communities are now integrating adaptation strategies in their municipal plans (Oulahen et al., 2018; Eyzaguirre & Warren, 2014). The context of climate adaptation differs depending on the location and the level of action at the local, municipal, or community level (Mimura et al., 2014). The growing recognition of municipalities as legitimate and appropriate bodies to plan and implement adaptation actions began in the mid-1990s (Guyadeen, Henstra & Thistlethwaite, 2019; Araos et al. 2016; Aylett, 2015). Since then, many municipalities have added adaptation and mitigation to their policy agenda, developing and implementing climate adaptation plans (Oulahen et al., 2018; Reckien et al. 2018).

The recent attention to adaptation at the municipal level is based on several factors. Cutter et al. (2000, as cited in Measham et al., 2011) assert that the impacts of climate change are felt directly by local communities. Thus, these impacts may vary from one geographical scope to the other; for instance, one community may experience extreme flooding while others may not, which emphasizes the need for local-based distinct approaches to climate vulnerability analysis and adaptation. Agrawal (2008) also argues that municipalities are usually legitimate and responsible for providing general planning services and managing community impacts, so they offer a reliable platform for adaptation consideration and achievement. Adaptation at the municipal level provides community members or citizens the opportunity to be part of the adaptation process (e.g., they can be engaged in identifying impacts and providing solutions). This creates an avenue for citizens to understand adaptation and act accordingly without forcing people to change their way of life (Jacques, 2006). It is said that municipalities are closer to community members and stakeholders, which provides a better platform for decision-makers to understand the community's vulnerabilities and develop suitable methods to climate adaptation (Guyadeen et al. 2019; Aguiar et al. 2018; Geneletti and Zardo 2016). Moreover, municipalities when able to access adequate support and funding are the best-positioned authority to protect people and properties from impacts of climate change through the implementation of community-based climate policies (Reckien et al., 2018; Araos et al., 2016; Rosenzweig et al., 2010).

There have been many adaptive activities that respond to the impacts of climate change since the release of the Fourth Assessment Report (AR4) of the IPCC in 2007 (Mimura et al., 2014). One remarkable development after the publication of the AR4 is the development of adaptation plans and strategies at the national, subnational, community, and private scale. This progress cuts across the globe; thus, it is evident in both the global North and South (Munaretto et

al., 2014; Mimura et al., 2014). Planning for climate adaptation requires making decisions regarding climate change impacts and uncertainties (Mitchell, Aalst, & Villanueva, 2010; ESPACE, 2008). Therefore, some central pillars to consider when planning for adaptation include iterative assessment, flexible and adaptive planning, and enhancement of adaptive capacity (Mimura et al., 2014, p. 876). At the national level, the tension between immediately pressing priorities and medium-to-long-term adaptation plans poses a significant problem (Mimura et al., 2014). Municipal-based adaptation practice has become predominant in most countries. Municipalities present several ways of addressing climate vulnerabilities by linking climate stressors (such as high temperature, extreme rainfall, and drought) to non-climate stressors (such as lack of education, population, and land use change) and finding appropriate ways of dealing with community needs (Mimura et al., 2014). According to IPCC (2007), non-climate stressors have the potential to affect the ecosystem through their effects on climate, therefore, effective adaptation needs to pay attention to both stressors. Notable exemplar municipalities that have achieved some adaptation goals since their engagement in adaptation include (among others): Mexico City, Toronto, New York City, and Albay Province in the Philippines. Their achievements are based on several factors and engagements including support from the private sector, civil society organizations, communities, and national government, as well as effective local leadership and the involvement of scientists and other experts (Mimura et al., 2014).

Canada's context for municipal adaptation planning is no exception (Eyzaguirre & Warren, 2014). Studies by Eyzaguirre & Warren (2014) and Robinson and Gore (2011) reveal a rise in adaptation activity among Canadian municipalities over the last 10 to 15 years, indicating an excellent acceptance rate for municipal climate adaptation. However, at the time of those studies, Nova Scotia was the only province that had given the mandate to municipalities to prepare and

develop their own climate change plans. The provincial government required each municipality to create a Municipal Climate Change Action Plan. In that plan, municipalities must identify urgent areas for climate adaptation and activities to minimize greenhouse gas emissions (Nova Scotia, 2011, as cited in Guyadeen, Henstra, & Thistlethwaite, 2019). However, in other provinces, municipalities can include climate change-related policies in their official municipal plans. For instance, the provincial government of Ontario allowed municipalities to add climate change policies to various sections of their municipal plans (Guyadeen, Thistlethwaite, & Henstra, 2019).

In Canada, the Partners for Climate Protection (PCP) program, hosted by Local Governments for Sustainability (ICLEI) and the Federation of Canadian Municipalities (FCM), has been the steering forum for municipalities engaged in climate adaptation and mitigation actions (Robinson and Gore, 2011). This program network has over 300 Canadian municipalities committed to taking action regarding climate change (Guyadeen, et al. 2019; Local Governments for Sustainability-ICLEI, 2019). These municipalities are concerned with integrating adaptation into community planning, partnerships with other organizations and cities, and politicians and government agencies to help them in their adaptation journey. The main purpose of adaptation is to promote municipalities' resilience to climate change (Mehdi et al., 2006). However, municipalities' ability to address climate change impacts or adjust to climate changes has been questionable, stemming from social, financial, and natural factors.

2.1.3 Small-medium-sized municipalities in adaptation

There has been a significant transformation of human settlement pattern over the years, which provides the basis for contemporary discourse on urbanization argument that about half of the world's population now reside in urban centers and is estimated to reach 60% by 2030 (Corfee-

Morlot, 2009). Indeed, about 81.48% of Canada's population lives in urban centers as of 2019 (O'Neill, 2021). However, it is also asserted that a significant percentage of the population living in urban areas resides in small-medium-sized municipalities (Servillo et al., 2017). In the case of Canada, 36% of the 81.48% reside in small-medium-sized municipalities (Flatt, 2019). Moreover, scholars posit that small-medium-sized municipalities outnumber larger municipalities, usually known as metropolitan areas (Grossmann & Mallach, 2021; Paterson et al., 2021; Häußler & Haupt, 2021). This indicates the importance of small-medium-sized municipalities in the development of a country.

There is no specific definition for small-medium size municipalities that relates to all geographical contexts. However, most people attempt to distinguish such municipalities by small numbers of the population, low economic activity, and less population density (Bruce et al., 2004). According to Raetz & Hedman (2021), the United States of America (USA) defines its small-medium size municipalities as those with populations ranging from 50,000 to 500,000. Canada defines its small municipalities as ranging from 1,000 to 29,999 in population and its medium municipalities as ranging from 30,000 to 99,999 (Statistics Canada, 2017). To promote international research constituting population and facilitate international comparison based on population, the Organization for Economic Co-operation and Development (OECD) explains small-medium-sized municipalities as those with populations between 50,000 and 500,000 (OECD (2021), which is the same as the USA. This study adopts the definition from Statistics Canada to access the implementation barriers in western Newfoundland.

Although small-medium size municipalities serve as a home for a significant number of populations, they have received less attention, both in adaption policies and research, than larger municipalities, both in Canada and across the world (Paterson et al., 2017). Larger municipalities

such as Toronto, Vancouver, Calgary, to mention but a few, have identified and implemented different adaptation scenarios. In contrast, climate adaptation still remains at the margins of small-medium-sized municipalities in Canada (Hill & Perun, 2017). Planning and policy implementation in these small-medium-sized municipalities is hampered mainly by several factors. The most crucial factor is the lack of necessary resources, limiting the successful implementation of municipal services. (Häußler & Haupt, 2021, Flatt, 2019). Häußler & Haupt (2021) propose regional government systems as a potential solution to this issue. According to them, having such a system enables municipalities who cannot afford certain municipal services to be able to do so through a collective use of resources to achieve desired goal that benefit all municipalities involved. Section 2.4, therefore, presents in detail the literature regarding the barriers that small-medium-sized municipalities face in adapting to climate change.

2.1.4 Municipal adaptation implementation and tools

There is less academic literature on the *implementation* of adaptation plans, unlike information that talks about the *concept* of adaptation, plans, strategies, and policies; this aspect is more fully addressed in the academic literature (Mimura et al., 2014). Information regarding implementation (e.g., projects and cases) is usually found in reports and factsheets from international organizations, national and subnational governments, civil service organizations, and non-governmental organizations (Mimura et al., 2014; Mullan, 2013). However, implementation is as important as planning. According to Durlak (2011), implementation is crucial in attaining project outcomes, and the quality of implementation relates to the quality of the outcome. The City of Barrie, Ontario (2018, p. 11) states that "planning for implementation improves the likelihood of effective adaptation, provides new opportunities for outreach and engagement, and fosters long-term sustainability of the action by integrating multiple streams of support." In climate adaptation,

there is no single approach or method for implementation. Municipalities are different, and each has to consider its own geography and the various climatic impacts it is facing. Legislation, regulations, institutions, and traditions also differ by municipality. An approach used by one municipality may not work for other municipalities. However, municipalities can learn from each other and adjust approaches used by others to suit their own realities, including their own land use and infrastructure plans (Richardson, 2010).

The Fifth Assessment Report of the IPCC presented some sectoral adaptation topics and practices, including public health, agriculture, water resources, disaster risk management, among other approaches employed, including both traditional and contemporary approaches (Minura et al., 2014). For instance, in the agriculture sector, farmers worldwide are adapting to the changing climate. Common practices among farmers include the changing of sowing times, rehabilitation of degraded pastures, agroforestry, integration of crop-livestock systems, fertilizer application, and irrigation (Lasco et al., 2011; Olesen et al., 2011), among other technical strategies like reducing tillage activities (Thomas et al., 2007). Effective water management is also connected to adaptation in the agriculture sector (Minura et al., 2014). In the health sector, developing early warning systems has proven to help deal with the impact of heat-related risks (Bierbaum et al., 2013). Some of the tools that municipalities use in adaptation include but are not limited to regulatory, restrictions, and structural tools (British Columbia Ministry of Environment (BCME), 2013). Below is a brief description of the tools.

- **Regulatory tools:** Municipalities use regulatory tools such as land use and subdivision regulations, development permit, and building regulations to adjust development to cope with changing climate. For instance, municipalities use development permits to regulate

where specific development can or cannot take place to solve some climate impacts like flooding. This tool usually demands the approval of the municipal council (BCME, 2013).

- **Restrictions tools**: This tool focuses on regulatory functions other than the ones listed above. These include land acquisition, land trust, transfer of development potential, etc. – for instance, local government can use land purchase to create a buffer to prevent the impact of high-level sea rise (BCME, 2013).

Municipalities can use the above tools to implement adaptation in their respective locations. Moreover, municipalities should also focus on building community members' capacity through programs such as awareness creation and education to expose to them the realities regarding the risks associated with climate change. Such activities can help promote the implementation of adaptation in municipalities (UNFCCC, 2013).

Furthermore, to make planning and implementation of adaptation simpler and more concise, ICLEI Canada has developed a framework – the Building Adaptive & Resilient Communities (BARC) framework (Figure 1). This tool presents a comprehensive and well-structured approach to respond to the impacts of climate change, protect people and properties, and also develop and implement adaptation plans to improve municipalities' resilience to climate change (ICLEI, 2010). The framework consists of five milestones, which are progressive steps that municipalities can follow to adapt to the changing climate. Each step of the process uses and builds upon findings from previous steps, and this provides municipalities the opportunity to review and re-evaluate results, findings, and decisions.

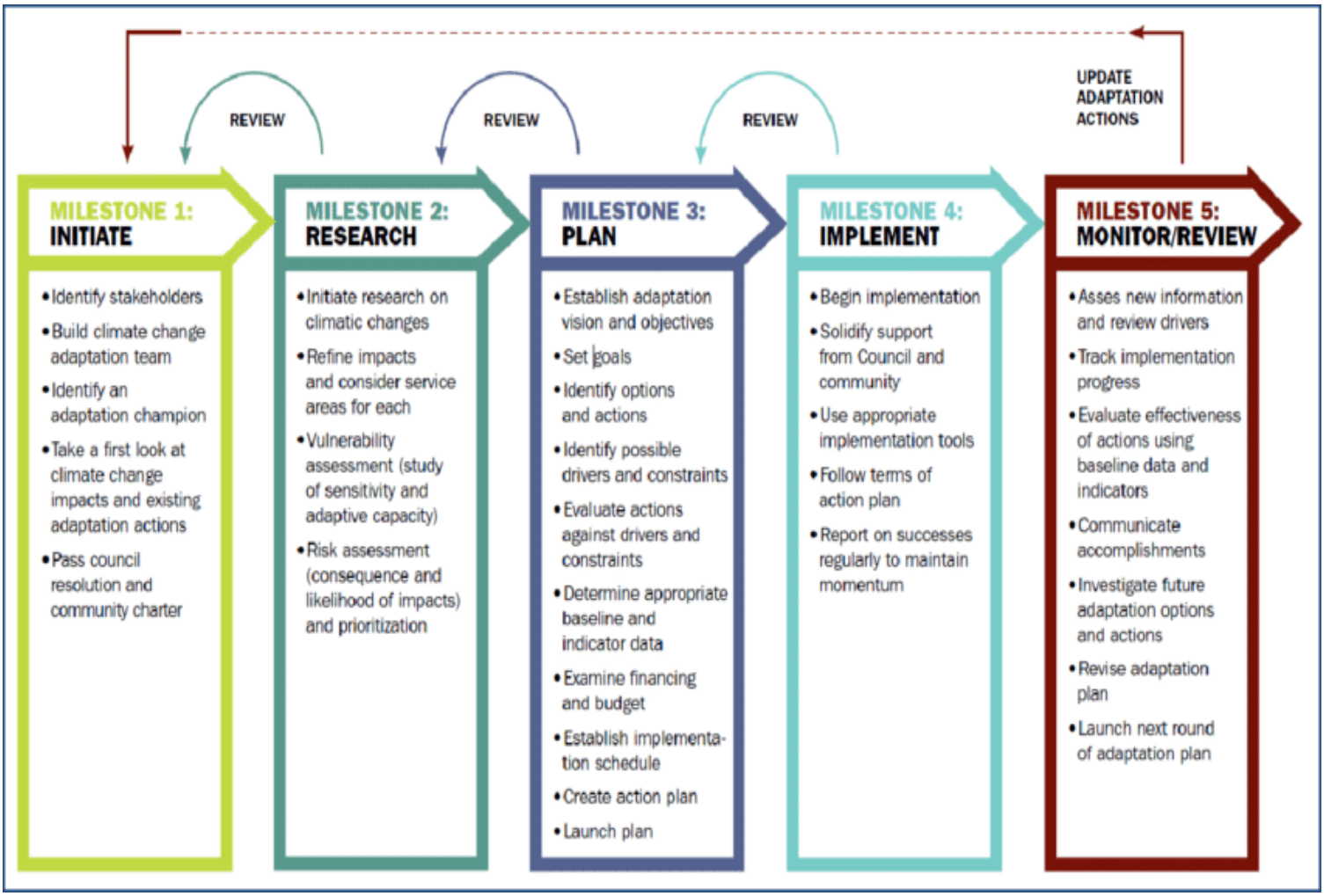

Figure 1 ICLEI's five milestones for adaptation planning and implementation

Source: ICLEI (2010, p. 8)

As indicated in Figure 1, the first process is to initiate (i.e., having the thoughts to start adaptation in the municipality). This process provides the municipality the opportunity to identify stakeholders with interest in adaptation who will be part of the team and also seek political acceptance, which is very crucial in local governance (ICLEI, 2010). The second milestone comprises getting adequate insight and understanding on existing and future climate change impacts as well as vulnerable areas and sectors (ICLEI, 2010). This information will guide the municipality to set goals and objectives, and also identify some opportunities and constraints that

can help solve the impacts identified, hence the third milestone, which is planning. When plans are prepared, the most important thing is follow-through; therefore, the fourth milestone is to implement plans. However, as mentioned earlier, this stage of the process has not received adequate attention. At this stage it is key to get support and approval from council, municipal staff, and community. Finally, the fifth milestone, which is monitoring, is to see whether goals and objectives set by the municipality have been achieved or not, identify challenges and problems, develop solutions to problems identified, and communicate progress to community members and stakeholders (ICLEI, 2010).

2.2 Climate change governance

2.2.1 Multi-level governance of climate change

Underdal (2010) postulates that an environmental issue as complex as climate change requires a unique governance system, one that combines efforts at all scales of development and levels of government. Moreover, Sainz de Murieta and Setzer (2019) suggest that multiple stakeholders are interested in climate change. Also, climate change is a priority environmental issue across different government levels, which makes it a natural fit for multi-level governance. MLG involves decentralizing some power and authority from the central or national government to the local levels, to develop their adaptive initiatives (Di Gregorio et al., 2019). Most of the relevant literature presents MLG as an important tool needed to build, grow, and adapt to climate change successfully (Bauer, & Steurer, 2014; Underdal, 2010; Bulkeley et al., 2009; McEvoy, Lindley, & Handley, 2006). Given the various political, social, and economic aspects or environmental governance, a multi-level viewpoint is highly relevant (Betsill and Bulkeley 2006). Biermann et al. (2016) and Ostrom and Janssen (2005) opine that MLG may be an excellent

instrument for implementing adaptation; however, success is not always guaranteed in such a complex system. The concept of multi-level governance focuses on different governance levels, agencies, government and non-government sectors (Dickinson and Burton, 2011; McEvoy et al., 2006).

MLG constitutes a flexible framework to understand the relationships between the different levels of government, adaptation policy issues, and other non-governmental actors (Corfee-Morlot et al., 2009; Bulkeley and Schoeder, 2008; Betsill and Bulkeley 2004). There has been a significant transition in terms of local interest and participation in climate change issues. The high interest in local adaptation requires a new level of governance that decentralizes power and authority to enable design and implement actions that best solve or reduce local impacts (Corfee-Morlot et al., 2009). According to Corfee-Morlot et al. (2009), the primary aim of multi-level governance in climate change is to promote collaboration and combined efforts towards achieving resilience through implementing actions that reduce emissions and enhance climate adaptation. MLG presents a better understanding of the political economy. This is because this approach breaks down decision-making and authority. Such authority is shared between different government levels, thereby making transparent how policy-making is across different sectors and municipalities (Corfee-Morlot et al., 2009; Betsill et al., 2006).

The concept of MLG is not meant to give the impression that state or federal government is weak or unable to perform its duties; however, it provides a new way of defining the scale and scope of federal activities (Betsill & Bulkeley, 2006). There are two dimensions concerning MLG: the vertical dimension and the horizontal dimension. The horizontal dimension considers relationships across the same level of government – for instance, across different municipalities (Vogel, 2015). The vertical dimension considers relationships between different government levels

– for instance, between federal, provincial, municipal levels (Vogel, 2015). There are two ways in which the vertical dimension of MLG can manifest. There is the bottom-up approach, where local actions determine actions at the national level, and the top-down approach, where national initiatives influence local actions (Corfee-Morlot et al., 2009). All actors have different functions distinct from the other, though there may be similarities. ICLEI's Cities for Climate Protection (CCP) network is an ideal example of MLG for climate change. Political powers are redeployed vertically downwards to municipalities, upward to multinational or transnational bodies, and horizontally to non-governmental stakeholders. This program is widely known and engaged with by international, national, and local governments, as well as other actors interested in climate change (Corfee-Morlot et al., 2009; Betsill & Bulkeley, 2006). Moreover, aside the vertical and horizontal dimensions, there are types of MLG – type I and type II MLG. The type I MLG perceives MLG as consisting of few levels of government. This type has a well-defined jurisdictional boundary where powers for decision-making is spread across limited number of jurisdictions. These jurisdictions undertake up several responsibilities and functions with distinct roles which prevent overlapping of roles and disagreement among its membership. This type is usually associated with federalist system governance (Zürn, 2020; Hooghe, & Marks, 2003). However, the type II conceives MLG as demand driven – that is they exist to solve a particular problem and once that is solved, it focuses changes. This type is flexible and involves a lot of jurisdictions as compared to the type I. This type provides the avenue for jurisdictions to join resources to solve a particular problem (Zürn, 2020; Hooghe, & Marks, 2003). This type is usually common at the local levels of government. Literature posits that both the types I & II employs the vertical and horizontal dimensions of MLG in their application (Zürn, 2020).

2.2.2 Local multi-level governance of climate change

The literature concerning climate change adaptation presents the role of local governments as essential in addressing the various problems relating to planning and implementation of climate change adaptation (Fuhr, Hickmann, & Kern, 2018; Matthews, 2012; Rosenzweig and Solecki, 2010; Simon, 2010; Blanco and Alberti, 2009; Sanchez-Rodriguez, 2009; Corfee Morlot et al. 2009). In a global study on urban governance, Broto and Bulkeley (2013) show that, the local government level is responsible for 66% of adaptation in urban centres. A study conducted by Aylett (2014) on ICLEI municipalities revealed that 63% of the cities had more than one staff member who was responsible for climate change planning. Although there is a significant contribution from local government in climate adaptation, researchers, scholars, and policy analysts suggest the need for partnership between civil society, the private sector, and the public sector (Bauer & Steurer, 2014: Tompkins and Eakin, 2012; Howe, 2011; Agrawal, 2010; Berkhout et al., 2006). International organizations urge local governments to adopt a participatory and inclusive approach towards climate change adaptation planning and implementation (Ford et al., 2011; Moser and Satterthwaite, 2010; World Bank, 2010; Ensor and Berger, 2009; Moser, 2008; UNDP, 2004). One key element in MLG is partnership (Broto et al., 2013). Betsill et al. (2006) posit that municipalities can build relationships with different stakeholders, improve climate education through public participation, and increase climate campaigns to catch the national government's attention for support. At the local level, climate actors may come from the private sector and civil society. These partners can help municipalities to implement climate adaptation actions (Aylett, 2014). According to a study by Hughes (2015), the substantial need of local governments for funding makes the network of climate adaptation more complicated. He emphasizes the importance of vertical and horizontal dimensions of partnerships in implementing

adaptation actions. Creating a cross-sector partnership is also known to be a good way of preparing and implementing adaptation plans. Many municipalities have created these partnerships to address the issue regarding implementation at the local level (Aylett, 2014). Adding to the importance of cross-sector partnerships, non-state actors were rated high in supporting municipalities to implement adaptation and mitigation actions (Aylett, 2014).

2.2.3 Canadian context

In Canada, the system of government used is the federal system. It formally divides autonomous power and authority between the two levels of government – federal and provincial (Sancton 2000). There are 10 provinces in Canada and three territories. Municipalities in Canada exclusively derive their authority, functional responsibilities, and other powers from the provincial level of government. This means that the provinces devolve obligations and legal rights to municipalities to function as governments; hence, municipalities are expected to implement policy and plan directives from the province (Fowler and Siegel 2002), which most often put certain pressure on municipalities as they strive to meet provincial target at the same time meet local demands. There is high recognition of climate adaptation in Canada. It is acknowledged that there will be an increase in climate impacts, and thus there is the need to explore taking advantage of the opportunities and preparing for the dangers these impacts will bring (Bednar, Raikes, & McBean, 2018). Adaptation at the federal level is governed by departments: Health Canada, Natural Resources Canada (NRCan), Environment and Climate Change Canada, and Indian and Northern Affairs – currently the Crown-Indigenous Relations and Northern Affairs (Bauer & Steurer, 2014). Among the four departments, NRCan (Climate Change Impacts and Adaptation Division (CCIAD)) and Environment Canada (Adaptation Impacts and Research Service (AIRS)) are the major adaptation groups (groups that support municipalities regarding adaptation) in the

country. Moreover, every province and territories also have departments that are responsible for developing climate change policies, strategies, and initiatives for municipalities. For instance, in the NL province, the Climate Change Branch - Department of Municipal Affairs and Environment is responsible for all climate change related policies and actions. These departments contribute to adaptation in many ways, ranging from climate change assessments to surveys to climate adaptation programs, etc. (Burton & Dickinson, 2011).

Between 2009 and 2012, each of these four departments received CAD 85.9 million each from the federal coffers for adaptation as a means towards the achievement of the Clean Air Agenda. NRCan used 30 million dollars to create a Regional Adaptation Collaboratives (RAC) Program in 2009, which was to be in operation from 2009 to 2012. In total, the program had six RAC (Bauer & Steurer, 2014). Moreover, the NL Department of Municipal Affairs and Environment (climate change branch) launched "The Way Forward on Climate Change in Newfoundland and Labrador" Plan to guide municipalities. The plan included 17 initiatives towards building resilience to the impacts of climate change in the province. Many climate change consortiums also exist at the provincial level. Examples include Ouranos in Ontario, and the Pacific Climate Impacts Consortium (PCIC) in British Columbia. These groups contribute immensely towards adaptation in the country (Burton & Dickinson, 2011). The Federation of Canadian Municipalities (FCM), in collaboration with ICLEI under the PCP program, has been an excellent support for municipalities in Canada on their journey to climate adaptation. Employing the 5-milestone framework proposed by ICLEI has played a significant role in adaptation in municipalities. The FCM continues to call upon the federal government to assist municipalities with enough funds to plan and implement adaptation (Bednar, Raikes, & McBean, 2018; Bauer & Steurer, 2014).

Although there has been a significant increase in the number of municipalities practicing adaptation, it is mostly bigger municipalities that have contributed substantial efforts towards climate adaptation. It is postulated that such municipalities have the needed human resources (municipal planners and practitioners) to push the climate adaptation agenda through, as well as the related negotiation skills, coordination capacity, and implementation facilitation (Hanna, Seasons, Dale and Filion, 2014). They are also embedded in larger and stronger networks. For instance, actors in Metro Vancouver's climate adaptation include government, private industry, research institutions, community-based organizations, not-for-profit organizations, and Indigenous groups (Graham & Mitchell, 2016). However, most small municipalities lack such human resources and network connections to move adaptation efforts forward (Bausch & Koziol, 2020). It is against this backdrop that the MLG concept is crucial in this study, to help the researcher identify whether MLG can help small municipalities combat climate change.

2.3 Partnership and collaboration

There is no doubt that climate change impacts are complex and thus require varying ideas and solutions that go beyond political, social, and economic boundaries to address the impacts that last into the future (Burton, 2016). This has resulted in recognition of the value of employing cross-sector social partnership or collaboration as an instrument to engage various actors from different fields, expertise, and perspectives to help address the complex issue of climate change (Carmona et al., 2014; Máñez Costa, 2013, as cited in Surminski & Leck, 2016). The importance of collaboration among stakeholders and the crucial roles local governments play in designing and implementing climate adaptation are evident throughout the literature (Sun, Clarke, & MacDonald, 2020; Fuhr, Hickmann, & Kern, 2018; Bauer & Steurer, 2014; Matthews, 2012; Tompkins and Eakin, 2012; Howe, 2011; Agrawal, 2010; Rosenzweig and Solecki, 2010; Simon, 2010; Blanco

and Alberti, 2009; Sanchez-Rodriguez, 2009; Corfee Morlot et al. 2009; Berkhout et al., 2006). A partnership can be said to be in operation when multiple actors or parties come together to identify a problem and address the issue through collective implementation (Burton, 2016).

Cross-sector social partnership (CSSP) is defined by Selsky & Parker (2005) as cross-sector-based project and programs designed purposely for addressing social problems and engaging partners actively and regularly. It can be on a short-, medium-, or long-term basis. Issues that cross-sector social partnerships can address include climate change, community capacity building, poverty alleviation, economic development, health care, education, and environmental sustainability (Selsky, & Parker, 2005). Relevant research identifies four different ways of entering into CSSPs. Types include private–public partnerships, non-profit–private partnerships, non-profit–public partnerships, and multi-stakeholder partnerships (Sun, Clarke, & MacDonald, 2020; Van Tulder, Seitanidi, Crane, & Brammer, 2016; Selsky, & Parker, 2005). Although all four types of CSSP are essential and contribute greatly to implementing initiatives, more focus is placed on the multi-stakeholder partnership approach when it comes to climate change adaptation (Sun et al., 2020; Surminski & Leck, 2016). It is also more comprehensive because it usually involves partners from the other three approaches mentioned. Multi-stakeholder is ideal for complex environmental problems that go beyond the capacity and scope of local government (Sun, Clarke, & MacDonald, 2020; Van Tulder, Seitanidi, Crane, & Brammer, 2016; Selsky, & Parker, 2005). Partners that constitute multi-stakeholder partnerships are local government, academics, non-governmental organizations, local businesses, community associations, etc. (Sun et al., 2020).

In the multi-stakeholder approach, local governments are typically the lead actors for implementing climate adaptation. They coordinate and mobilize public engagement through established policies and agendas (Bulkeley & Betsill, 2005). The substantial pursuit of

collaboration at the local and municipal levels is based on manifestations of city-based stakeholder engagement partnerships which offers diverse perspectives towards climate adaptation (Kalesnikaite, 2019; Surminski & Leck, 2016). Some examples indicating stakeholder engagement partnerships led by cities are given by Carmin, Dodman, and Chu (2013, pp. 24-25) cities included Toronto, Quito in Ecuador, London, and Walvis Bay in South Africa. Additionally, the Saint John City in NL collaborated with the New Brunswick Climate Change Secretariat and FCM to develop its climate change adaptation plan (City of Saint John, 2020). Partnerships include different stakeholders with diverse expertise, knowledge, methods, perspectives, and resources coming together to address complex challenges (Sun et al., 2020). Margerum & Robinson (2015) posit that although multi-stakeholder partnerships present a positive and desired outcome, developing partnerships is complex and requires significant investment. Sun et al. (2020) suggest that encouraging municipal stakeholder engagement partnerships requires enlightenment on the process, skills, tools, and structure for working within partnerships.

2.4 Implementation barriers

As indicated in the literature, there is no single approach to climate adaptation implementation and so there are a wide variety of challenges that can be encountered (Richardson, 2010; Klein et al., 2007; Smit & Pilifosova, 2003). Barriers differ based on jurisdictions as well as stage of the decision-making or implementation process. This suggests that how a particular barrier restricts adaptation success can be different in different contexts (Minura et al., 2014). Biesbroek et al. (2013) explain that every barrier's severity and importance changes with time and interreacts with other challenges when not controlled. For instance, when the problem of inadequate financial resources is not addressed in a timely manner, funds required at a given point in time will not be the same in the future due to inflation, hence, that severity of that problem increases. Also,

inadequate financial resources can exacerbate the issue of human resource which is an existing problem. Additionally, studies have shown that different stages of the decision-making process encounter different barriers. For instance, barriers encountered at the agenda-setting phase of the decision-making process might be different than those encountered at the implementation or monitoring and evaluation phase (Minura et al., 2014; Dannevig et al., 2012; Mees et al., 2012; Moser and Ekstrom, 2010).

There is an assumption that Canadian municipalities possess many resources; however, this alleged strength is not reflected in adaptation implementation (Burch, 2010). This suggests that it is important to look at the multifaceted process of implementing local adaptation actions, not just initial capacity (Burch, 2010a; Bulkeley & Betsill, 2005). Also, municipalities are seen as essential service providers, which imposes a lot of responsibilities such as providing primary infrastructure (e.g. municipal road construction, provision of social amenities, etc), thereby leaving them with little resources to implement other important actions like adaptation especially in small municipalities (Measham et al., 2011). Literature has identified a myriad of constraints that municipalities face in local adaptation; nevertheless, it is also essential to understand that barriers to adaptation implementation are location-specific, and hence, there is the need to understand in detail those factors that hinder the implementation of climate adaptation in a specific location (Barnett et al., 2015; Eisenack et al., 2014). Additionally, most of the current relevant studies focus on large municipalities with a high populations and resources, and so the adaptation barriers identified may not be applicable to small municipalities (Mackay, Hennessey, & Mackey, 2019).

Measham et al. (2011) studied municipal climate adaptation barriers, focusing on three municipalities with population sizes ranging from 27,737 to 212,531, which would be considered large municipalities. They identify three significant barriers: lack of information (i.e., municipal

vulnerability information, climate forecast, and predictions); institutional limitations (e.g., policies imposed by higher levels of government, the commitment of higher levels of government to adaptation); and limited financial and human resources (especially given the diverse activities municipalities must engage in). Technology transfer (adopting techniques from one geographical area to another) and building staff capacity remain challenging at the local level (Pini, Wild River, McKenzie, 2007). Campos et al. (2017) survey the role of adaptation on municipal planning agendas. They consider all types of municipalities from small to large; however, their analysis does not explicitly spell out the problems faced by small municipalities. The survey reveals that a lack of cooperation and knowledge is a general problem faced by municipalities. Driessen, Hegger, Mees & Uittenbroek (2019) and Hardoy, Hernández, Pacheco, & Sierra (2014) identify an ineffective participatory approach as a hindrance to municipal climate adaption. There is no doubt that it requires community participation to materialize plans prepared (Driessen, Hegger, Mees & Runhaar, 2017), and implementation of adaptation plans solely by the local government may not yield the results needed to reduce the impact of climate change in the locality (Driessen, Hegger, Mees & Uittenbroek, 2019).

There have been several studies on barriers to adaptation within Canada, across different levels of government and various sectors such as the forest management sector. Barriers identified by these studies include inadequate resources, insufficient knowledge, poor coordination between levels of government, poor governance structure, inadequate assessment of current impacts, lack of monitoring, among others (Bednar et al., 2018; Oulahen et al., 2018; Henstra, 2017; Williamson & Nelson, 2017; Burch, 2010a). Burch (2010a) categorizes the barriers into four classifications – behavioral or cultural barriers, legislative or regulatory barriers, contextual barriers, and structural barriers. According to Burch, behavioral barriers are those barriers that are related to individual

relationships within the municipality or organization. The way that people live affect how they respond to matters as well as their individual personalities, which can serve as a barrier when there are conflicting views among individuals within the same organization (Burch, 2010a). Legislative barriers refer to the restricted tools available at the municipal level to plan and implement policies. Also, the relationship and interactions between different government levels can be barriers to implementation, especially when there is a conflict of interest (Burch, 2010a). Contextual barriers result from the municipality's geographic location, the citizens' priorities, and values (Burch, 2010a). Last but not the least, structural barriers are those barriers related to the municipal arrangement and structure in terms of decision-making and finances, which can affect both short-term and long-term activities in the municipality (Burch, 2010). The barriers identified are interconnected in many ways, so that one barrier may be strengthened by the presence of another barrier to create a substantial hindrance towards achieving the adaptation goals of the municipality (Burch, 2010).

Furthermore, Bednar et al. (2018) classify adaptation barriers under three categories: conceptual, knowledge-based, and socio-political. Under the conceptual barrier, they emphasize that the term adaptation has different meanings depending on the domain in which it is used. For instance, adaptation may refer to addressing vehicle efficiencies and emissions in the transport industry while it may mean something different in another field. Its lack of specificity affects its implementation (Bednar et al., 2018). With respect to the knowledge-based barrier, one of the focus areas is the lack of local expertise. The imbalance of expertise in Canadian municipalities contributes to adaptation implementation failure. Bednar et al. argue that larger municipalities in Canada have access to larger administrative capacities and can leverage them to benefit from high-level expertise to implement adaptation. However, the same cannot be said for smaller

municipalities in the country (Bednar et al., 2018). Regarding the socio-political barriers, one of the concerns was jurisdictional boundaries. Although there is high recognition of a multi-level approach to climate adaptation, actors' responsibilities are not clearly stated, which complicates multi-level governance in climate adaptation. Moreover, in Canada, local governments are creatures of the provincial government. Thus, the absence of climate adaptation legislation at the provincial level means local governments have to set their own rules and responsibilities. This most often brings jurisdictional conflicts across local government and affects implementation.

2.5 Summary of chapter

The literature has demonstrated the importance of local climate adaptation, where municipalities are encouraged to effectively integrate adaptation into existing processes, policies, and mechanisms. It presents different tools and approaches available for municipalities to use (e.g., regulatory tools, ICLEI framework). The chapter has given insight into the multi-level governance of climate adaption, the importance of collaboration in implementing climate adaptation at the local level, and some of the barriers to climate change adaptation. However, most of the literature available presents information on larger municipalities and generic terms that contradict the literature on adaptation as context based. Therefore, this study aims to explore the tools small municipalities adopt for adaptation implementation, understand the multi-level governance element of effective climate adaptation (pros and cons) in small municipalities, and present some ideas and recommendations to counter the various challenges small municipalities face in their quest for adaptation implementation. Information presented in this chapter will serve as basis for discussion as well as methods for exploring primary sources of information which will be discussed in the next chapter.

Chapter 3: Research design

3.0 Introduction

Chapters 1 and 2 have confirmed the importance of mainstreaming climate change adaptation in development planning, especially for local levels of government. The literature has indicated, however, that while climate change planning is common across most municipal or local governments, its implementation is questionable. Many larger municipalities are using their resources to implement adaptation in their jurisdictions, but the same cannot be said regarding small to medium municipalities. Moreover, research indicates that adaptation implementation challenges differ between municipalities, and that the bulk of the current literature is focused on larger municipalities. Therefore, the purpose of this thesis is to further explore the implementation challenges faced by small municipalities in Newfoundland as they work toward adopting strategies to adapt to climate changes.

This chapter provides a comprehensive explanation of the overall research design of the thesis. The first part of the chapter elaborates on the methodology selected for the thesis, an inductive case-study approach, and also offers justification for the selection of the case study municipalities. The second part of this chapter provides explanations on specific methods used for data collection and analysis (i.e., from recruiting participants to coding of responses) and the last section provides limitations of the study.

3.1 Methodology

This study employs the inductive approach. That is, the research aims to collect relevant data and information related to a broad topic (municipal climate change adaptation) and the study's

objectives, without the use of any formal predictions or hypothesis. The inductive approach allows for data collection to be open ended. However, once a significant amount of data can provide relevant and sufficient ideas for the existing problem, data collection will cease (Burney & Saleem, 2008; Schmitz, 2012). This characteristic of the inductive approach gives the researcher the ability to provide enough data to both support existing literature and contribute new ideas to the scholarly body of knowledge (Thomas, 2006). The inductive approach makes it easier for the study to integrate pre-existing literature into a conversation with the collected data, (Thomas, 2006). For instance, the literature review demonstrated a variety of potential implementation challenges, which gave the research a starting point and basis for further exploration. The research's inductive approach is also justified by the qualitative nature of data collected and analyzed (Gabriel, 2013). As well, the inductive method was ideal for the research due to the small number of cases. The inductive (i.e., exploratory, and open-ended) approach pairs naturally with a small number of cases which allows more detail to be captured about each one and qualitative data (i.e., which can capture richness and complexity).

One of the most significant weaknesses of using the inductive approach is scope limitation, which makes generalizing findings a bit problematic. For instance, a single observation from one context-specific case may not apply to other cases with their own unique contexts; thus, further observations may be needed to get a firm conclusion (Regoli, 2016). To counter this limitation somewhat, this research uses three case studies, which should allow for some balance between richness and generalizability.

The small number of cases means that the study is using the 'small-N' approach. This approach is suitable for studies that focus on exploratory work to understanding existing issues, either environmental or social problems that have been under-researched (Yin 2013). The study,

therefore, considers three municipalities on the island portion of the Province of Newfoundland and Labrador and applies climate theories and concepts to understand climate adaptation planning and implementation at the municipal level. This approach makes it possible to examine these cases in detail while also using information from the literature to make comparisons in order to ensure the validity and generalizability of the findings (Lieberson, 1991). Also, the study intends to derive results that will primarily benefit a specific jurisdiction (i.e., the province of Newfoundland and Labrador), making the small-N approach suitable. In contrast, the 'large-N' approach tends to examine more than a few items or cases at a time, which can be time-consuming (Richards, 2015). According to Zainal (2007), the case-study approach is appropriate for asking questions about the complex nature of social systems and provides some understanding of the process of change in such scenarios. In summary, Merriam (1998) presents five characteristics of the case-study approach:

- One does not have control over variables in question
- Requires several sources of information
- Has a holistic description and interpretation of results
- More specific to small population
- Requires analysis of multiple variables that are interconnected

There are limitations to this approach, such as the method's inability to provide an adequate scientific generalization of a phenomenon (Zainal, 2007). However, the case-study approach is the best fit for this study due to the myriad of factors that affect climate adaptation, the several sources of information used to make good adaptation decisions, the multifaceted nature of factors, the aim to better understand planning and implementation of climate adaptation measures at the municipal level, and the possibility of lessons for other small municipalities.

3.2 Case description and selection

As mentioned in the previous section, three small municipalities are considered in this study. Cases include the Town of Deer Lake, the Town of Stephenville, and the Town of Port aux Basques, which are all situated in the Western portion of the Island of Newfoundland. The study defines small municipalities as municipalities whose population are under 10,000 peoples. According to Census Canada (2017), small population centres (population living in the inner and secondary core of the municipal area) are those with population between 1,000 to 29,000. However, due to the relatively small population of the province, it was prudent to set the range to be up to 10,000 people (which is still within the range 1,000 – 29,999) in order not to consider municipalities that are known to be larger in the province. The province is composed of the Island of Newfoundland and a much larger mainland, Labrador (Hiller, 2021). The Island of Newfoundland is divided into three portions – western, central, and eastern (Heritage Newfoundland and Labrador, n.d.). The cases selected are all located in the western region. Due to time constraints limiting the number of cases that could be included, it was prudent to focus on one region primarily so that the cases would be more comparable.

The Town of Deer Lake is located east of the City of Corner Brook and west of the Town of Grand Falls-Windsor (Baird Planning Associates, 2018). The Town of Deer Lake plays an essential role in transportation in the province because it has the largest airport in the western region of Newfoundland. The Town of Stephenville is situated on the coast of Bay St. George (Atlantic Ocean) in southwestern Newfoundland. It has a small international airport that supports general aviation rather than the commercial transport focus of Deer Lake (Town of Stephenville, 2014).

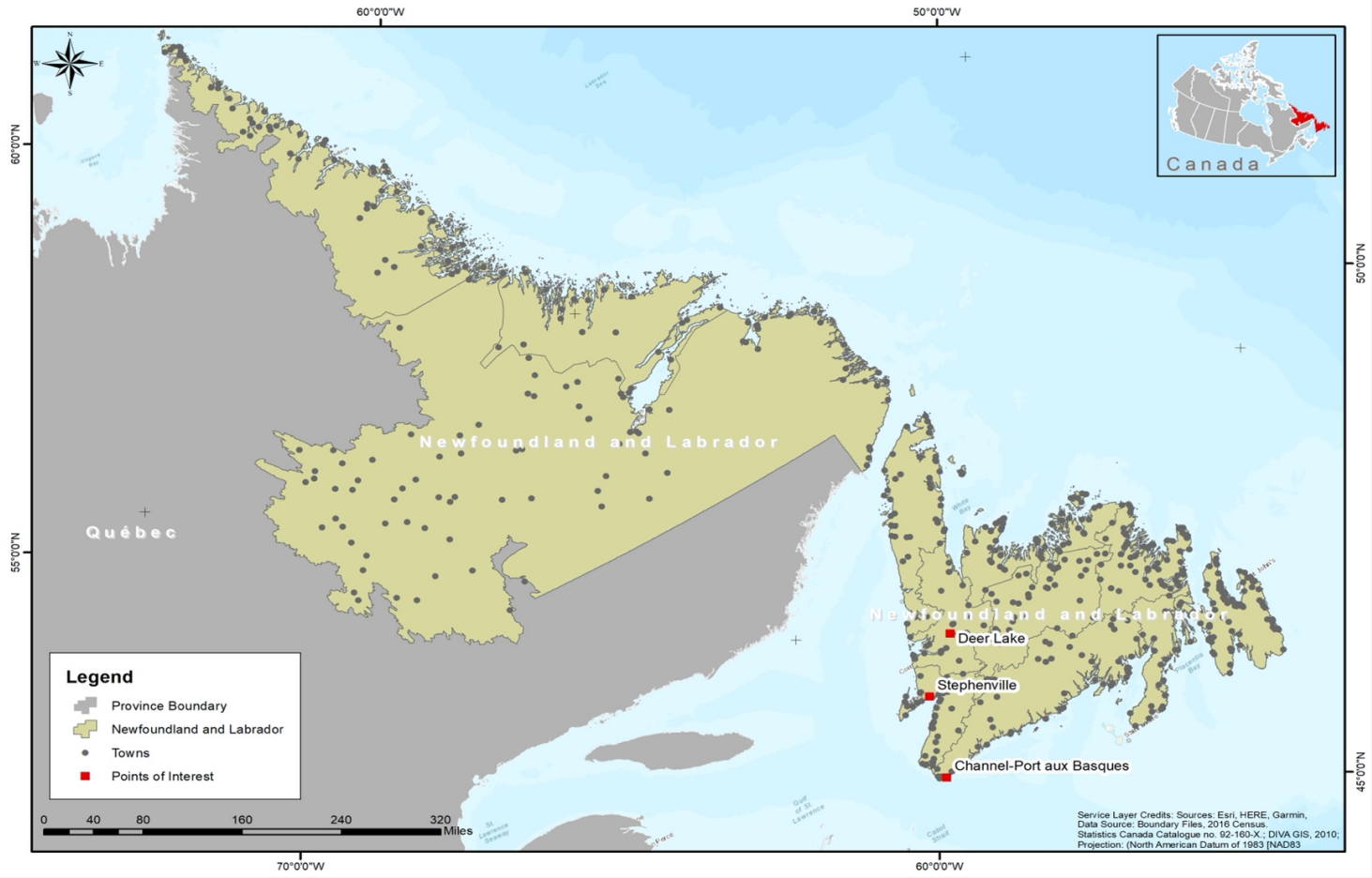

Figure 2 Map showing case study municipalities

Source: Author's construct using ArcGIS, 2021

The Town of Port aux Basques is known to be among the oldest towns or settlements on the Island. It is located at the far end of the southwestern part of the Island of Newfoundland, facing the Cabot Strait (Atlantic Ocean). The Town is the primary entry point of the Marine Atlantic Gulf Ferry from Nova Scotia. This ferry service is the largest employer for the citizens of the Town (Town of Channel-Port aux Basque, 2019).

In selecting the three cases, specific criteria were considered to choose municipalities that fit the study's objectives. According to Yin (2014), conducting case-study research requires the setting of criteria to select cases that will be suitable for the research questions. The selected cases

were chosen based on the population, climate change impacts, available data and resources and location.

The first criterion was to consider the population of potential case study municipalities. The emphasis of the study was on small municipalities; hence this criterion was fundamental. Subsequently, Deer Lake, Stephenville, and Port aux Basques have populations of 5,550, 6,623, and 4,067, respectively, which can be considered small municipalities and a good fit for the study, not to mention that they are similar in size. The second criterion is that municipalities must be experiencing clear impacts of climate change. The study's focus was on climate adaptation implementation; if a municipality was not experiencing impacts of climate change, there would be no implementation, so it could not be a case study for this work. These selected municipalities are clearly being impacted by climate change (e.g., flooding and water level rise in Deer Lake and Stephenville; sea-level rise and coastal erosion in Port aux Basque). The third and fourth criteria focused on the availability of resources and data as well as location. Moreover, the study focus was on Canada – Newfoundland and Labrador province specifically the western region of Newfoundland, and thus municipalities had to be in the province. The province was selected due to its proximity to the researcher and limited academic research on its small municipalities regarding climate change adaptation.

3.3 Brief overview of municipalities under study

3.3.1 Port aux Basques

According to the 2016 Census, the population of Port aux Basques is currently approximated at 4,067 people, which is slightly above the size recorded in 2011 of about 3,794. However, the current population is still less than the 2006 population of about 4113 people and

much less than the 2001 population of about 4,637 people, representing approximately a 12% decrease in population from 2001 to 2016 (Town of Channel-Port aux Basques, 2019). The population fluctuations can be attributed significantly to the natural decline of population (i.e. deaths exceeding births) and high levels of out-migration, particularly among youth due to attractive and high-paying jobs in other provinces. Although the Town has experienced a decline in population from 2011 to 2016 (15 years), the population of the Town has increased by 7.2% (273 peoples) from 2011 to 2016 (Town of Channel-Port Aux Basques, 2019; Newfoundland and Labrador Department of Finance, Economic and Statistics Branch, 2007). This increase can be attributed partly to net migration. From the 2016 census, it was recorded that, the number of populations between the ages of 55 to 64 increase by 4.1% within the period of 2011-2016. These population were residents who migrated out of the town to work and have returned because of pension purposes, thus adding to the increase of population from 2011 to 2016 (Town of Channel-Port Aux Basques, 2019). Currently, the Town's population size seems steady as it continues to

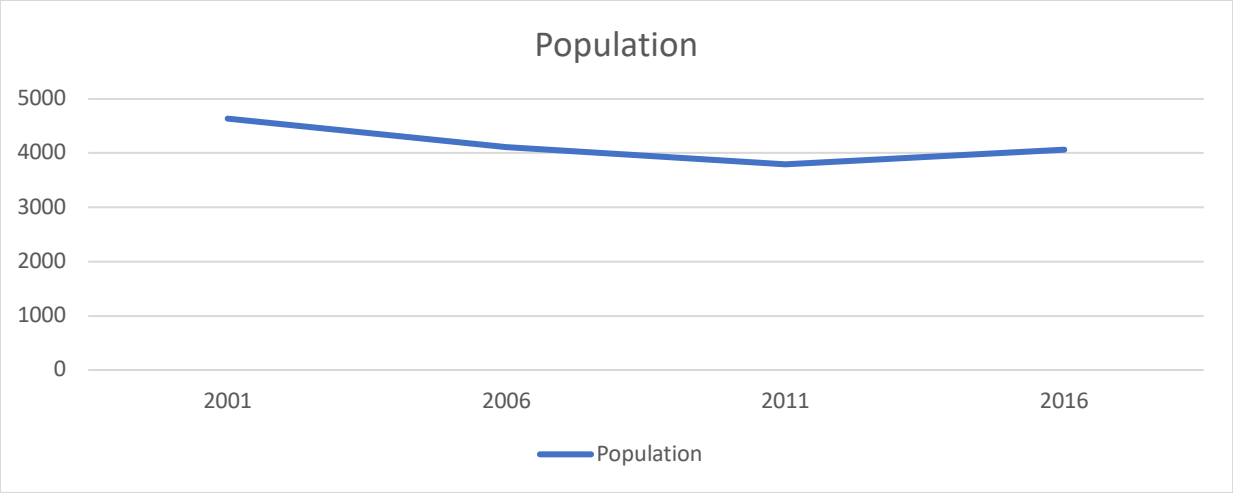

Figure 3 Population change of Port aux Basque (2001-2016)

Source: Town of Channel-Port Aux Basques, 2019

provide needed basic amenities and employment opportunities. The above figure provides a graphic representation of the population growth in the Town of Port aux Basque.

The Town of Port aux Basque has a land area of about 41.4 square kilometres and a total catchment area (area of population that uses municipal services) of approximately 9,000 persons, which extends east to the Town of Rose Blanche about 42 kilometres away. The Town is also comprised of four districts areas, namely: Mouse Island, the Channel, Grand Bay East, and Grand Bay West. This municipality is known to be a hub of tourism activity in the province because of the ferry port (Town of Channel-Port Aux Basques, 2019).

3.3.2 Town of Deer Lake

The current population of Deer Lake is 5,249 people, up slightly from the 2011 population, which was 4,995, and much more than the population of 4,769 recorded in 2001 (Town of Deer Lake, 2018; Newfoundland and Labrador Department of Finance, Economic and Statistics Branch, 2007). The 2006 population was 4,827. The 2016 population represents a growth of approximately 8.7% from 2006. The significant growth in population is attributed to several factors. One is in relation to a construction boom and high oil and commodity prices in Deer Lake which has been great for building the economy of the town (Town of Deer Lake, 2018). Also, Deer Lake expanded its services as a regional service centre and transportation hub for the Northern Peninsula and Western Newfoundland, which contributed greatly to the increase. Figure 4 gives a pictorial view of the increase in population of Deer Lake from 2001 to 2016.

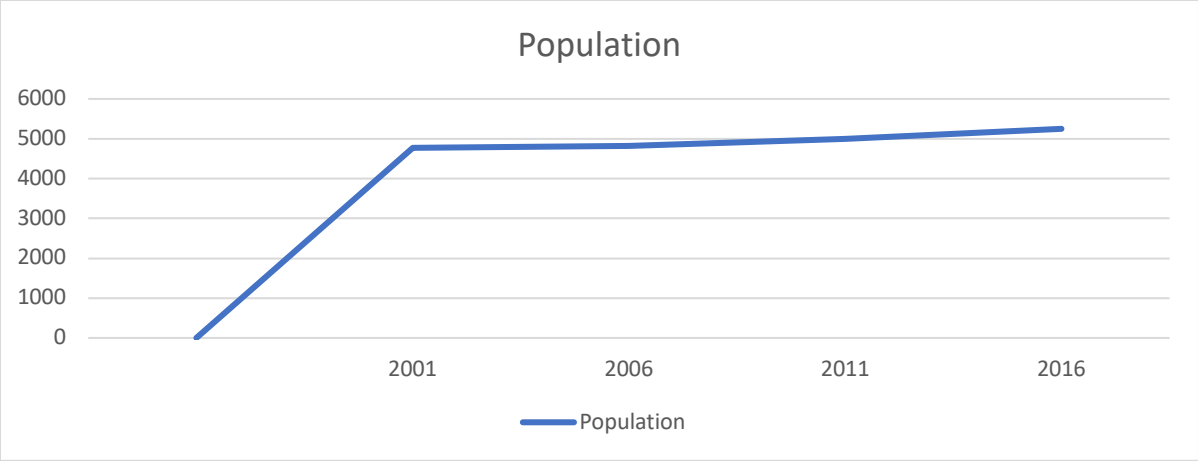

Figure 4 Population change of Deer Lake

Source: Town of Deer Lake, 2018

The catchment area of Deer Lake is made up of two towns – St. Judes and the town of Deer Lake. The town of St. Judes serves as Local Service District. The Town of Deer Lake is known to be a hub for outdoor sports in the province, including hunting, fishing, hiking, snowmobiling, and others. It also has multi-purpose trails that connect to wider regional trail networks; these activities and services also attracts a lot of people into the Town (Town of Deer Lake, 2018).

3.3.3 Town of Stephenville

The current population of the Stephenville, according to the 2016 census, is 6,623 people, which is slightly below the population recorded in 2011 (6,719), slightly above the 2006 population (6588), and much less than the 2001 population of 7,109 (Town of Stephenville, 2016). The Town of Stephenville has been experiencing a decline in population at an average rate of about 0.46% per year over the past 15 years (2001-2016.) (Town of Stephenville, 2016). The below figure gives a graphical representation of the decline in population of the Town.

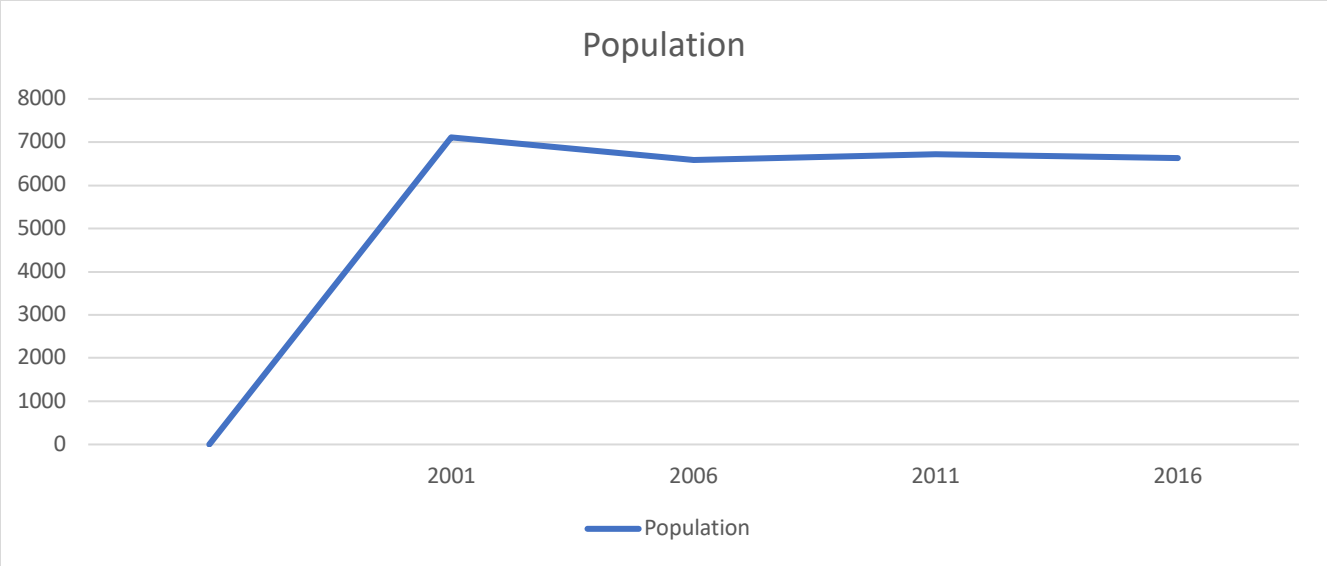

Figure 5 Population change in Stephenville

Source: Town of Stephenville, 2016

This decline is attributed partly to the collapse of the Abitibi Price Paper Mill, which was a major source of employment for the populace of the Stephenville (Town of Stephenville, 2016). The collapse contributed to out-migration from the Town. Most people who were employed by the company moved to Alberta to work, leaving their families (Walter, 2008). The flow of money from Alberta into the Town provides some sustenance as the Town tries to revive the economy through investments in the construction sector, which is booming and employing quite a number of people, as well as the summer tourism sector, not to mention small- and medium-sized businesses (Walter, 2008). The Town has a total land area of about 35 square kilometres and serves as a service centre for a catchment area containing approximately 25,000 people. The town is a home to the Scottish, English, French, and Mi'kmaw Indigenous ancestries with unique culture and traditions which attracts a lot of tourists into the town. It also supports transportation in the province through transport facilities such as port and airport (Town of Stephenville, 2016).

3.4 Methods

3.4.1 Data collection

As stated above, the study employs the small-N approach and therefore requires qualitative data to understand the complex nature of climate change at the local level (see Richards, 2015). The study uses semi-structured interviews (see table 1 below) to collect primary data. According to Easwaramoorth & Zarinpoush (2006), an interview is a conversation for gathering information. It is used when there is the need to collect in-depth information on people's opinions, thoughts, and experiences on a particular subject. Researchers assert that interviews build a holistic snapshot, report detailed views of informants, and allow the participant to "speak in their voice and express their thoughts and feelings" (Berg, 2007, p. 96). This method is ideal for this study because participants can express their views and provide reliable qualitative data required to make conclusions and recommendations.

In terms of the actual process, first and foremost, preliminary conversations were undertaken with key informants to get their thoughts on the study objectives. The preliminary conversations enabled the researcher to fine-tune the research proposal and helped with selecting case municipalities and possible contacts for the actual interviews. Some of the key informants were later contacted to participate in an actual interview since they played a crucial role in adaptation decision making for the selected municipalities.

Secondly, academic literature and municipal documents regarding municipal climate adaptation were reviewed to broaden the researcher's understanding of municipal climate adaptation, tools and initiatives municipalities use for adaptation, possible future strategies to build communities' adaptive capacities and provided some answers to the researcher's interview

questions. Also, this process helped the researcher structure the interview questions appropriately to achieve the study's objectives. Documents reviewed included official development plans, climate change reports, briefing reports, and other valuable documents, keeping in mind the review of academic research on municipal climate change adaptation.

The third step was the recruitment and administering of interviews with participants. Prior to recruiting participants, an ethics application was submitted to and approved by the Grenfell Campus Research Ethics Board (GC-REB) with file number 20211242. This process ensured that the research would not pose any undue physical, psychological, social, or financial threat or risk to participants. After the approval of the ethics application, the researcher proceeded to recruit participants to participate in the interview. Potential participants were recruited from contacts recommended by key informants during the preliminary conversations and also from public staff directories on the internet. Also, interviewed participants recommended further potential participants (i.e., in a process of snowball sampling). An email was sent to potential participants, and once a positive response was received, they were given a consent form to sign, agreeing to partake in the research. However, participants who could not provide a digital signature consented to participate orally at the beginning of the interview.

After the interview request was accepted, an interview date was set to favor both the interviewee and the interviewer. The study followed a semi-structured style (see Table 1) to collect the primary data and all interviews were done on phone not in person. During the interview, a brief introduction was made, giving the importance and objectives of the research, and the interview proceeded. Questions regarding climate change adaptation, particularly regarding implementation and partnerships, were asked to participants. It was estimated that about ten participants would be

Table 1 Guiding interview questions

Semi-structured interview ~30 to 60 minutes

Introduction

The purpose of the research is to better understand the barriers to implementing climate change adaptation in small municipalities. Through this interview, I hope to learn more about municipal adaptation planning, some opportunities, and the challenges faced. Some questions may require a follow-up question. Do you have any questions before we begin?

Consent: A consent form has been sent to the interviewee.

Interview questions

- ✓ What is your current role in climate change adaptation in the town?
- ✓ What are some of the current impacts of climate change affecting the town?
- ✓ What climate change adaptation measures are already in place?
- ✓ What new climate change adaptation measures are in development?
- ✓ What process does the town go through to implement such measures?
  - Which actors or stakeholders are involved in climate adaptation in the town?
  - How many partners contribute to adaptation in the town?
- ✓ What are some of the barriers the town has encountered in pursuing climate change adaptation?
  - Political
  - Social
  - Economic
- ✓ What is the role of other governments (municipal, provincial, federal) in your pursuits of adaptation?
- ✓ What are some of the potential remedies or strategies for overcoming the barriers?

Thank you!!

interviewed; ultimately, nine participants agreed to be interviewed. The interviews took an average of 40 minutes each, and above are the interview questions.

Given the semi-structured style, these questions were not strictly adhered to. This is because there were unplanned questions that came as a follow-up to an answer given and also

some listed questions were not relevant to certain participants and thus were skipped. The interviews were completed between January and April 2021. Below is a breakdown of participants interviewed (Table 2).

Table 2 Participants interviewed

Organization	**Participants**
Town of Deer Lake	Participant 1; Participant 2
Town of Stephenville	Participant 3
Town of Port Aux Basque	Participant 4
Provincial municipalities network	Participant 5
Consulting firms	Participant 6; Participant 7; Participant 8
Environmental non-government organization	Participant 9

Table 2 presents the number of participants that were interviewed for the study. It comprised of the three municipalities under study, provincial municipal networks, and private businesses. Some of these organizations and interviewees were not from the towns themselves, however, their operations expand to almost all municipalities in the province and thus, their participation was crucial to the study. For instance, most of the non-government organizations in the province work closely with small municipalities in the province to offer advice and suggestions on climate actions such municipalities can implement. Moreover, municipalities under study most often consulted consulting firms to aid in plan preparation, funding application, and community participation.

3.4.2 Data analysis

Qualitative analysis was used to analyze the data collected. This method was used because the study aimed at analysing qualitative data, and qualitative analysis is the natural method to extract meaning from qualitative data (Elo et al., 2014). In analyzing the data, content analysis, a tool used in the qualitative analysis, was employed. This tool allows the researcher to create themes

that can be used to categorize data being analyzed, thereby reducing the raw data and making it easy to work with (Elo et al., 2008). The basic process used in content analysis includes open coding, generating themes, and abstraction (Elo et al., 2008). The study adopted the approach described in Elo et al. (2008).

During the interviews, conversations with interviewees were recorded and later transcribed. The transcripts were read several times to explore and get familiar with the contents. While reading the transcripts, the researcher started developing codes from the data by highlighting the text in different colours for the different codes. This process was repeated until all data were read, and codes set. Codes that emerged from reading the transcripts were later developed into themes by merging codes to be used as headings. Themes covered the key comments passed on by participants. Codes were reviewed by the researcher to ensure salient points were captured. This enabled the researcher to know the most recurring codes, the different approaches used by various participants to answer a type of question, and whether there are some relationships and similarities between and among codes. Examples of codes and themes that emerged from the transcripts are adaptation measures/options, climate change impacts on small municipalities, funding streams, etc. It is believed that once these queries have been run and data well explored, it will give the researcher a solid basis for the reporting of findings (Adu, 2019; Gibson & O'Connor, 2003).

3.5 Researcher positionality

In conducting qualitative research, it is crucial to acknowledge the researcher's view and position on the research topic. This is because the researcher's beliefs and position can influence the interpretation and outcome of the research results (Holmes, 2020; Bourke, 2014). Looking at my geographical and social orientation, it is important to highlight my position as a researcher and

how it affected the entire research process. As a black lady undertaking research focused on government systems in a white community, there was no doubt for them to see me as a 'stranger' (see Fisher, 2015; Bourke, 2014). Kusek & Smiley (2014) establish that the gender of the researcher can influence the research process. Female researchers most often face gender-based discrimination especially in field work which often affect the outcome of the research (Kusek & Smiley, 2014; Chattopadhyay 2012). To my knowledge, my position as a female in this research did not put me in such position, probably because of the nature of the data collection process - phone interviews instead of in-person and because it was for an academic purpose. I found the participants to be open-minded people who were eager to share whatever information was needed for the research. As I mentioned earlier, I was seen as a stranger or outsider more than an insider looking at my geographical background. Me as a stranger was confirmed as almost all participants I interviewed asked me the question - where do you come from? I presume that this stranger/outsider status was accompanied by some opportunities, as participants were helpful responding to interview questions and challenges regarding the fact that I was new to analysing different government structures or systems.

Participants seeing me as stranger influenced the way they answered my questions, which I think may have been quite opposite to Chang (2002) and Fries-Britt & Turner (2002) argument on commonality. They established that researchers undertaking local research, or research based on where they come from, have the advantage of getting information due to that fact that participants see such researchers as their own and tend to be more friendly and share needed information. In my case participants saw my interest in municipal planning, and they were willing and happy to teach me how the system works here, and the things municipalities can and cannot do. My status as a stranger may have even enhanced my objectivity and the ability to analyse the

research findings without any prejudice (Henry, 2003). However, I could also assume that my position as a 'stranger' might be a reason why some proposed participants did not respond to my emails.

As stated, I was confronted by some challenges embedded in the Canadian government system. In Ghana, where I come from, there are just two spheres of government – national and local government (municipalities). Local governments (municipalities) have the power and authority to set their own goals and objectives, and implement plans prepared. However, this is not the case in Canada. Municipalities in Canada are creatures of the provincial governments and derive their mandates from the provincial government. The differences in government structure triggered my desire to understand the Canadian system, hence I did my internship with the City of Corner Brook. The internship and conversations I had prior to my research enlightened knowledge on municipal governance system in Canada and that influenced the nature of interview questions to set and direction of the thesis. During the research, I noticed that plans that are prepared by the municipalities are known as municipal plans, and they are usually for a period of ten years. That was quite different from municipalities in Ghana. They call the municipal plans 'medium-term plans' which are prepared for a period of four years. Additionally, there were some sorts of similarities regarding the structure of the municipalities (in terms of organization structure). For instance, in both countries municipalities have the planning, engineering, finance, etc. offices which made it quite easy for me to know the who to contact based on the research topic.

3.6 Limitations of the study

In the study, the researcher experienced limited access to data due to the category of people that the research was centered on. The research aimed at interviewing development practitioners

at the municipal level and partners that contribute to adaptation in the municipality or in the province broadly. Initially, the study was intended to focus on one municipality; however, during the data collection, the researcher realized that due to the low number of development practitioners in small municipalities, there was the need to extend the number of cases. Even with the extension of study cases, data collection was hampered by late responses and non-responses to invitations sent to some identified municipalities. This was partly due to the challenges that the coronavirus pandemic placed on municipalities, making their staff even busier and constrained than usual. Besides, the data collection period was at the same time as the end of the fiscal year for municipalities. Therefore, the project was only able to interview four practitioners collectively from the three municipalities, and five participants from private and non-government organizations. Also, due to time constraints, the research could not extend the study to outside the Western Newfoundland region.

The final step in the research is the reporting, where themes will be presented to fit the goal of the thesis project. This process is presented in the next chapter.

Chapter 4: Results and discussion

4.0 Introduction

This chapter presents results and discusses findings to answer the research questions outlined in chapter one. Results and findings are from the review of municipal documents and interviews conducted. The chapter consists of six sections. Section 4.1 presents the findings and analysis on the impacts of climate change on the towns. Section 4.2 concentrates on the measures adopted by these municipalities to harness or reduce impacts mentions in the previous section, section 4.3 presents findings regarding the process of deciding and implementing climate adaptation. MLG and its importance are discussed under section 4.4 and sections 4.5 and 4.6 presents the discussions on the implementation barriers and the solutions or remedies to address barriers identified from the data collected respectively.

4.1 Climate change impacts

This section presents the findings and results regarding the impacts of climate change in the municipalities under study. Impacts are grouped based on geographical context (i.e., by municipality) to understand and appreciate the climate problems that each municipality faces in relation to their population, infrastructure and communities.

4.1.1 Town of Deer Lake

The Town of Deer Lake is currently experiencing impacts from climate change, which were highlighted by interview participants. According to them, the major impacts of climate change for the Town are riverbank erosion, extreme rainfall events, high levels of groundwater, and forest fire risks (see Bradshaw, 2021; Kean, 2018). Riverbank erosion is the most significant

impact. This is caused by wintertime flooding from unusual rain events in the middle of the winter. According to the participants, this incidence has become very problematic and worrying in the Town, and traditionally was not very common. This problem affects residential streets that are along the river. These streets get eroded, coupled with the destruction of residential properties (see Kean, 2018). Also, some roads have water and sewer lines underneath, which also get affected and directly affect freshwater bodies in Deer Lake. Lawns are affected as well. This takes significant toll on the Town's infrastructure base, thereby necessitating excessive spending to fix such problems.

Despite the challenges that climate change poses to the Town, some opportunities come with the changing climate, and this is evident in comments from the interview participants. Participant 2 highlighted that:

> Here might be some climate change impacts in terms of adaptation that are of a benefit through the area in terms of being an agricultural pocket. Maybe the temperatures changing or having warmer temperature provides us the opportunity to try new crops and these kinds of things seem to be at play in that sector all around the Deer Lake area. We're dealing with farmers and producers about farming practices and educating them on crops they can try on as a result of the warming temperatures.

The later part of the participant's claim regarding warming temperatures supports Hansen et al., (2012) assertion on the positive impact of prolonged summer on agricultural activities. In their submission, they mentioned that, although impacts of climate change are negatively affecting municipalities, there are some benefits that are often not well acknowledged.

4.1.2 Town of Port aux Basques

The Town is experiencing changes in weather patterns and severe weather occurrences, including abnormally high winds, storm surges, coastal flooding, and shoreline destruction.

Though these occurrences have been happening for many years, they have become more frequent and severe than they were in previous years. In addition, the continuous rise in the average sea level in the Town increases the impacts of coastal flooding and storms. The biggest impact faced by the Town is coastal flooding, which is usually expected near the shoreline and near low-lying areas of the town. This impact affects coastal dwellers as well as their livelihoods (Participant 3). Participant 3 emphasized that shoreline or coastal activities come to a halt during such occurrences, which impedes sources of income from fishing activities, essentially creating unemployment until the problem gets fixed. Furthermore, high winds (sometimes over 180 kilometers an hour) combined with storm surges are damaging and can cause local flooding, which also damages the shoreline infrastructure. These occurrences do not just affect the income and livelihood of people, but also adversely impact municipal infrastructure and infrastructure used to deliver electricity and communications services to the people in the Town. An example of how climate change has been impacting the Town was stated in the Municipal Plan as follows:

> The town experienced a major storm surge in the year 2000 which caused significant damage to the southeasterly facing portions of the community (Mouse Island and Channel). In calculating the damages that has occurred, the team found out that, damages were up about 10 metres above sea level elevation (Town of Channel-Port Aux Basques, 2019, p. 33).

4.1.3 Town of Stephenville

The Town of Stephenville, like many other municipalities, has also been impacted by climate change. An interview with a participant 4 from the Town revealed that the major and current impact of climate change in the Town is extreme rainfall events, leading to localized flooding. According to the participant, this problem was not rampant some years back, compared to the present situation. They added that systems in the town were designed for average and short-

duration rainfall rather than intense and prolonged rainfall. Furthermore, the rainfall events impose significant stress on the current system. The participant stated that the rain comes in sudden bursts and lasts longer, which hinders absorption into the ground, thus leading to greater surface runoff. This, therefore, indicates that the groundwater supply is not being replenished. The excess runoff water causes local flooding in the town. Residential properties and infrastructure get destroyed as a result of flooding. These events pose a significant adverse effect on the economy of the Town – from repairing damaging structures to even relocating residents. In addition, Stephenville lies over glacial sand and gravels, which means the Town is vulnerable to shoreline erosion from wave impact and water runoff (Town of Stephenville, 2016).

The various municipalities confirm what the literature says concerning the uniqueness of climate impacts among different municipalities and jurisdictions. Therefore, it is advisable to understand and draw conclusions on climate change impacts and adaptation based on geographical context rather than making overly general remarks or recommendations. This is to say that what works for one community may or may not work for another community. Hence, tackling adaptation from a geographical perspective allows for approaches and solutions that will be meaningful to address the immediate problem (Mimura et al., 2014). Moreover, the section has provided knowledge on the various major impacts across the study municipalities and as stated each impact is distinct from the municipalities. Impacts from the study community reflected the provincial various studies on climate change impacts on NL (Government of Newfoundland and Labrador, 2019; Finnis, 2013; Bauer et al., 2010). This information will form basis to understanding the various measures each municipality adopt to reduce the impacts and as well the challenges faced.

4.2 Adaptation measures

This section provides results on the strategies that the various municipalities are adopting to reduce the observed impacts of climate change in their respective geographical regions and minimize effects on the local environment and economy. Table 3 summarizes the specific adaptation measures that these municipalities are using.

Table 3 Climate adaptation measures in case municipalities

Municipality	Impacts	Strategies	Source
Deer Lake	Riverbank erosion, Extreme rainfall events, Forest fire risks, High levels of groundwater	bank stabilization, bridge construction, trail improvements, control water levels	Participants 1 Participant 2 Municipal Plan
Port aux Basques	Coastal flooding, Storm surge, Severe winds, Shoreline destruction	Armor stones along the shoreline, regulations to control development in floodplain zones,	Participant 3 Municipal Plan
Stephenville	Extreme rainfall event, Flooding, High levels of groundwater	Redesigning capital projects to meet average rainfall precipitation, compost initiative, waste treatment facility	Municipal Plan Participant 4

Municipalities are doing their part to provide better infrastructure and services to their citizens to ensure a quality standard of living in the context of climate change. However, from the data collected, the quest of municipalities to provide these services is not an easy one. All municipalities studied are, in some way or another, considering adaptation in their day-to-day activities. For instance, from participant 1 Deer Lake is pursuing climate adaptation measures like bank stabilization and water level controls, but their overall adaptation strategy is more reactive

than proactive; that is, attention is given only when problems surface or resurface. In an interview with Participant 1, the participant stated that;

> Over the past 20 years there's been various temporary engineering projects that have been done and the major one is bank stabilization. So, when the riverbank erodes, the engineering team use what is most commonly called riprap and geotextile mat. First because the area is sandy and easily gets eroded, the geotextile mat is placed on the eroded area and the riprap which is like big boulders is placed on the mat to protect the soil as well protect bank from eroding. So, they've done that several times in several different areas around the town and that was to protect some road and water and sewer infrastructure.

The Town does not have an adaptation or climate action plan that spells out the short- or medium-term adaptation measures that must be fulfilled to counter the various local impacts. This was highlighted in a statement made by Participant 2:

> I think right now I would say Deer Lake is more kind of reacting to climate change impacts as opposed to getting ahead of the whole in an adaptation planning and implementation type of thing.

The strategies outlined by the Town are those activities that it has been undertaking whenever there is riverbank erosion over the past 20 years as mentioned earlier, and yet the problem persists (see Kean, 2019). This is because the Town does not use proactive measures (adaptation plan), where existing issues would be assessed, and a series of activities considered to understand the cause of the problem and prevent it from happening or reduce its occurrences. The situation is similar to study that was conducted in 2014 by University of British Colombia. Which confirmed that about 65% of small municipalities did not have adaptation plans that will guide their activities, even though they are adapting anyway. Though this study is not recent, this study found a similar trend which could probably mean that there are municipalities that are struggling with adaptation. Reactive adaptation is equally important; however, proactive adaptation offers a better understanding of the current risk systems and provides the avenue for cities to project future

climate behaviour which will enable them to plan adequately towards it. Most scholars posit that planning and anticipating for climate-related risks contribute greatly to minimising same events from happening again (see Brown, Naylor, & Quinn, 2017; Ash et al, 2012; Someshaw, n.d.)

Furthermore, major activities undertaken by the town of Port aux Basque to reducing climate impacts (coastal flooding and shoreline destruction) include the construction of amour stones along the coast and regulatory tools. The amour stones are large hard rocks that are usually put along the coast to protect the coast and the surrounding built environment. These rocks protect the coast from eroding by trapping and retaining the sand during heavy wind and rainfall and also deflecting wave energy which can destroy coastal shoreline and properties (Gunter, 2021). This was evident as the participant form the town stated that "we're putting in amour stones which are very big rocks along the shoreline and that diminishes the impact of the waves hitting the shoreline." Additionally, the town has employed the regulatory tool to manage the impacts of coastal flooding. This is seen in the literature, where the British Columbia Ministry of Environment (BCME, 2013) highlighted and explained the various tools that are available for municipalities to manage adaptation. In a conversation with Participant 3, the participant mentioned that;

> Our town plan includes areas that are considered environmental protected which is like you can't build in a floodplain or zone area. We have also included in our town plan and regulation the new provincial regulations which does not allow people to construct in the immediate areas towards the coastline

Examples of regulatory tools used by the town include zoning and rezoning to regulate the use and development of land in the town. This is done through text amendment, map updating among others. Again, the town uses the buffer and development permits to control individuals and private businesses from building on prohibited and protected coastal areas. The participant

attested that the above-mentioned regulatory tools has provided some sort of guidance for developers.

Flooding experienced in the town of Stephenville due to extreme rainfall is being managed by basically redesigning capital projects to meet the average amount of rainfall experiencing now and the future.

Port aux Basques and Stephenville have climate action plans as living documents that guide climate-related activities in each town. However, both action plans are geared towards mitigation rather than adaptation. They are filled with activities and actions that minimize the amount of greenhouse gas emissions released into the atmosphere, contributing to climate change. Such measures include using low-emission vehicles, improving energy efficiency within infrastructure, fuel switching, etc. Therefore, in as much as these two municipalities have binding and living documents on climate change, the adaptation form of climate change response is yet to be included; hence, like Deer Lake, they also resort to reactive measures to address adaptation issues in the municipalities. However, as stipulated in the literature, mitigation and adaptation are not mutually exclusive – some activities can contribute to achieving both adaptation and mitigation. For instance, these municipalities have compost initiatives in their action plan, which seek to mitigate and adapt to climate change. In an interview with Participant 2, the participant mentions that "we do not have an adaptation plan, but we have a compost program. It's a non-organic kind of composting program, and we've got some desires on community gardening." Similarly, Municipal Employee 4 stated that:

> I'm working right now on a project for a community compost initiative which would be on a large scale. We are initially going to start with the population between 750 people for the introduction in the pilot portion and will eventually move to full community

> composting. Another initiative is we've developed a subsurface wetland sewer treatment facility to help manage stormwater runoff.

Composting helps reduce the number of solid wastes sent to the landfill sites, thereby reducing methane emissions and pulling out carbon dioxide from the atmosphere, hence mitigating climate change by reducing greenhouse gas emissions. Moreover, composting can retain water by aiding the soil to hold moisture and prevent surface runoff caused by extreme rainfall events and thereby reduce and prevent flooding.

4.3 Decision-making and implementation process for adaptation

As identified in the literature, both planning and implementation are essential in the adaptation process, so this study places substantial focus on them, as well as decision making. As mentioned in Section 4.3, all three case municipalities lack a structured approach to implementing adaptation. Instead, implementation occurs as the need for it arises. Even so, these small municipalities do follow a process for adaptation, even if it is somewhat informal. Some of the steps taken by these municipalities are outlined below. Note that they do not necessarily need to occur in any particular order.

4.3.1 Assessment

When a climate impact is observed, the municipalities assess the nature of the problem and identify affected people and communities. Participant 1 stated that:

> an assessment is done by the municipality, and they decide what to do with it and if it's within the means of the municipality which happened several times while I worked there is that there was a little slip in the riverbank and what happened was public works went out, and they filled in the slip just to stabilize the road from giving way.

Assessing the extent of damages gives the municipalities an idea of what to do, such as whether to seek external support or use available resources to sustain and protect the affected community.

4.3.2 Collaboration with provincial, federal level and academia

Another approach identified was collaboration with the provincial and federal governments. Municipalities acknowledge that they do not always have the resources necessary to address local problems; therefore, they consult higher levels of government for assistance. Participant 2 stated that "…if erosion occurs, then we're trying to reach out to our provincial and federal government partners and agencies to see if there's mitigation funding that can help restore problem areas." Participant 2 also confirmed by stating that

> we did have somebody from the university that came to work with us last year in the summer of last year where the student did take a closer look at and made some recommendations for us from a compost program as well as a community gardening program.

Municipalities also apply for federal funding to aid them in providing solutions for such occurrences.

4.3.3 Industry partners

Municipalities consult businesses and industry partners in times of challenge to figure out how to minimize the impact of a climate change-related incidence. For example, participant 3 from Port aux Basques stated in a conversation that "yeah, we got some funding from Environmental Industry Association to do one of our buildings." In Deer Lake, the Airport has turned out to be a great contributor towards climate change actions in the municipality. It provided the municipality with some funds to improve the trail system along the river so as to make the trail more resilient to climate change. As well, a private company (Kruger) in Deer Lake implements climate

adaptation actions to control water level rise in the town. In Stephenville, for example, engineering firms and private developers are encouraged to incorporate green space and climate change design in all their development.

4.3.4 Other municipalities

Although climate change impacts are experienced differently across geographical contexts, their effects can spread to other planning areas. For instance, the Town of Pasadena, which is on the same lake as the Town of Deer Lake, faces flooding issues due to rising water levels of the lake. Due to this problem, there has been some collaboration between Pasadena and Deer Lake on measures to stabilize the lake. This collaboration can reduce flooding experienced in Pasadena and as well minimize erosion experienced in Deer Lake. Also, a participant from the town of Port aux Basques mentioned that the Town was part of a committee of six other communities in Newfoundland (i.e., Bauline, Torbay, Baie Verte, Stephenville, and Paradise), which discusses climate change adaptation in consultation with a particular consulting company.

The above-stated steps are some of the reactive steps (except perhaps the committee of communities) that the case municipalities usually follow to restore damages caused by climate change impacts. Throughout the study, it became clear that these steps essentially provide a temporary solution to the problem or slow down the impacts of climate change for a short period of time. Reactive management to reduce impacts of climate change is not a wrong approach; however, it can become ineffective in the absence of an overall understanding of climate risk in a particular geographical area (Someshwar, n.d.). For example, the impacts of riverbank erosion, surface flooding, and coastal flooding recorded in these municipalities keep ratcheting up, perhaps due to inability to these municipalities to project climate behavior in the future and plan resulting

from a lack of proactive adaptation planning. Unlike the Building Adaptive & Resilient Communities (BARC) framework presented in literature (ICLEI, 2010) which provides a more strategic approach (5 milestones) for adaptation, the case study municipalities did not follow same or similar categories as discussed in the literature. As already explained in the previous chapter, the BARC framework allows municipalities to explore adaptation through risk and vulnerability assessment which provides more information on existing impacts, enabling municipalities to proactively manage climate change impacts. Municipalities across Canada (e.g., City of Barrie, Town of Ajax, Town of Essex, Conception Bay South etc.) have used and reaped incredible results. Although some of these steps presented above are elements of some of the milestones, they are not planned and is done basically to tackle immediate crisis. For instance, in the step 2 of the milestone (which is research), municipalities undertake climate change impacts assessments, which can be seen from the above steps that the case study municipalities also undertake some sort of assessment, although such assessment is for a particular impact and not to understand the overall climate impacts in the municipalities. As presented above, the study municipalities do collaborate with other stakeholders (provincial, federal, other municipalities) to even implement temporary measures. This indicate that, the approaches used by these municipalities has the tendency to become a fertile ground to proactive adaptation when municipalities are adequately supported with the necessary resources for adaptation.

4.4 Multi-level governance (MLG)

As indicated in the literature, tackling climate change holistically in a particular context most often depends on two or more partners, following the complex nature of climate change as an environmental problem. Climate change adaptation over the years has been associated to municipalities since they are the main government level to respond to climate change impacts in

their area of jurisdiction. Therefore, it was necessary for the thesis to explore MLG, to find out if it applies among small municipalities and helps with understanding the challenges, they experience regarding climate change adaptation. To gather relevant information, study municipalities were asked about partners that contribute to climate change adaptation in their locality and their role in adaptation. This question was important because the literature indicated that, the MLG approach to climate change adaptation requires a concurrent participation of both government and non-government actors (Jing & Li 2019; Dickinson and Burton, 2011; McEvoy et al., 2006). The study found that 80% of participants interviewed had knowledge on MLG, while the remaining 20% did not actually know the meaning of MLG but could relate to it when the researcher explained it to them. The table below presents information on partners and potential partners that contribute to climate change adaptation in the municipalities and the province.

Table 4 Implementation partners

Deer Lake	Port Aux Basque	Stephenville	Province wide
• Deer Lake Airport • Pulp and paper company • Memorial University • Federation for Canadian Municipalities • Federal Government • Provincial Government • Town of Pasadena	• Consulting firm • Environmental Industries association • Six-member committee (made up of other municipalities) • Federation for Canadian Municipalities • Federal Government • Provincial Government	• Consulting firm • Six-member committee (made up of other municipalities) • Federation for Canadian Municipalities • Federal Government • Provincial Government	• Provincial municipalities networks • Environmental non-government organization Newfoundland and Labrador Geological Survey • Memorial University

Table 4 depicts some of the partners that contribute to climate change adaptation in the study municipalities and the province. Through the data collection process, municipalities

mentioned the implementation partners that support adaptation in their respective municipalities. The federal and provincial governments are the primary partners for the study municipalities, as evidenced by the comments of all municipal representatives interviewed. They provide funding, technical knowledge, and expertise to these municipalities. Interviewees mentioned that the provincial government most often assists them with funding and expertise in times of sudden climate events. Provincial government research on municipal vulnerability to climate change is made available to municipalities to aid in their planning. Participant 4 highlighted that

> We get some support from the federal government mostly in the area of funding but they also facilitate groups such as the partners for climate protection that I'm actually a member. So, they offer funding programs and some guidelines to municipalities.

The federal government provides funding support through the Department of Environment and Climate Change Canada's Climate Action fund which provides about $3 million yearly for activities geared towards climate change awareness and participation (Government of Canada, 2019). Moreover, through the Federation of Canadian Municipalities (FCM) (a non-profit corporation advocating for municipalities across the country), the federal government offers some funding programs such as Municipal Asset Management program, Municipalities for Climate Innovation program, Green Municipal fund, Disaster Mitigation and Adaptation Fund, etc. For instance, the federal government has invested over $1.3 million in Newfoundland and Labrador communities through the Municipal Asset Management program delivered through FCM (Government of Canada, 2019). Other programs offered by the federal government to municipalities include Investing in Canada Plan, Smart Cities Challenge, etc. (Government of Canada, 2019).

FCM provides an avenue for municipalities to explore adaptation and other climate change-related opportunities available to them. It offers funding, capacity-building, and training programs

to municipalities across the country, together with the federal government and other private partners. FCM provides guidelines for planning and implementing climate change measures to meet emission targets and adapt changes (ICLEI, 2010). The towns of Port aux Basques and Stephenville, for instance, are part of the Partners for Climate Protection (PCP) program initiated by FCM to provide insight on achieving targets on greenhouse gas emissions. Their participation in the program allows them to access federal funds (since some federal funding programs are facilitated by FCM) as well as other funding programs and get assistance regarding funding applications from experts. PCP provides five milestones for municipalities to pursue in mitigating climate change. Currently, both municipalities have been able to develop a climate action plan. Stephenville is yet to implement the plan, whilst Port aux Basques has initiated the implementation of projects in the plan. Both plans were developed in partnership with the same consulting company.

As for other types of partners, Memorial University contributes to climate adaptation by undertaking research and providing findings that municipalities can use to broaden their understanding of climate change. The university also undertake physical projects such as composting. Furthermore, this study also identified interaction among different actors within a particular government. For instance, one of the participants referenced their municipality's public works division and planning division working together to fix damages caused by climate change and plan together for future occurrences. The non-government organizations in the province also provide technical assistance to these municipalities through identifying projects that municipalities can implement in the area of climate adaptation and public engagement climate change. In a data collection interview with participant 6 from the non-government organization, the participant stated that "I would say so we are part of the planning stage, so what we do is to assist these

municipalities identify specific actions they can take to address real risks as a result of extreme weather conditions." Although, there are some forms of collaboration among climate partners or actors, study municipalities do not adequately engage the private sector which is pivotal to the success of adaptation (see Oulahen et al., 2018). This is evidence in most larger municipalities as their adaptation success is significantly associated to stronger adaptation networks such as the community-based organizations, not-for-profit organizations, and private businesses (Graham & Mitchell, 2016).

Betsill & Bulkeley (2006) posits that federal governments should support activities at the municipal levels of government which is evidence in this study. However, as to whether the support from the federal government is enough or not enough to aid adaptation in the small municipalities are discussed in section 4.5. Furthermore, FCM's involvement represents the importance of non-profit organization to MLG, where a national body advocates for municipalities and also provides frameworks and policies that municipalities can adopt to implement climate adaptation. Moreover, provincial legislation also gives municipalities the mandate to develop and implement their adaptation plans following guidelines provided by the province (Adriázola, Dellas, Tänzler, 2018; Corfee-Morlot et al., 2009). The study again demonstrated that municipalities communicate with different sectors of government agencies, private partners, and NGOs either on the same level or other levels to plan and implement actions (see Corfee-Morlot et al., 2009; Vogel, 2015).

4.4.1 Importance of MLG

Climate change is impacting municipalities, and municipalities are devoting substantial resources to reduce such impact on their communities. However, resources are scarce, and

municipalities are mandated to provide other social and infrastructure services to their citizens. The literature, therefore, assumes that for municipalities to achieve the goal of climate adaptation, they must pull resources from different levels of government and private organizations (Jing & Li 2019; Adriázola, Dellas, Tänzler, 2018, Bednar, Raikes, & McBean, 2018). To validate the literature, participants were asked about the importance of MLG in their operations towards climate change adaptation as well as about the sorts of actors that can be involved in MLG. All participating municipalities and NGOs responded positively to the concept of MLG in local governance as these participants were involved in MLG. According to municipalities interviewed, getting involved in MLG promotes the implementation of climate actions at the municipal level. Participant 3 stated that:

> Yes it is because when you get involved in projects of that nature, and you pull in other resources like other communities and networks in that regard, it makes an impact that shows that you're trying to move forward as a group to solve climate change-related problems.

Although most participants saw MLG positively influence implementing climate adaptation, some participants had contrasting ideas. For instance, some participants pointed out some limitations. They highlighted that:

> ….it is to a point. It is nice to have the input from all levels of government, and it's good to get funding at those levels. The biggest thing with it is that it takes a while to achieve anything if you have to go through multiple levels …… I understand that it is the funding we want, however, you don't get the funding just because you say you want it, like you must demonstrate reasons for it. I can understand that would be so many tiers that you would have to go through to get there but it would be nice if money was a little more available, I should think.

It can be deduced from the above statement that, although MLG can positively influence implementing adaptation at the local level, it may not do so on a timely basis. When too many people are involved in decision-making, it takes longer to conclude decisions that sometimes limit

plans prepared at the municipal level. Also, climate impacts that require reactive approaches to solve may not benefit from MLG since such impacts require quick attention. Coordination challenges may also affect the effective implementation of MLG at the local level. The bureaucratic nature of MLG usually impedes the implementation of plans especially for small municipalities with limited number of staff to manage MLG funding and other processes. Furthermore, as indicated in the literature, municipalities are creatures of the provincial government, which was evident in the province of Newfoundland. Study municipalities indicated that they do not have full autonomy over certain development actions or interventions because, they are financially handicapped and need to rely mostly on the provincial government support which is mostly either delayed or funding reduced due to the huge responsibilities associated to the province. Participant 1 mentioned that:

> ….the way it generally works is that when you have money from the provincial government there are certain objectives that the provincial government want done for that money so for example asbestos water lines in Newfoundland and Labrador is a problem in a lot of places and the provincial government wants to get rid of that so if you put in a proposal for money and then includes replacing asbestos water lines you have a better chance of getting that funding, however, that may not be a pressing need in your municipalities but because you need the money you may want to operate in that objective.

Provincial goal setting at the municipal level sometimes limits municipalities abilities to implement actions geared towards the actual problems within the town. The literature argues that municipalities are integral to a country's development because it is that level of government which is closer to the populace (Good, 2019). Therefore, provincial goal setting should consider and factor municipal priority areas in policy and decision-making processes.

4.5 Barriers

In developing and implementing climate adaptation, considerable challenges or barriers may arise. From this realization (which is common in the literature) and the importance of MLG (as established above), it follows that one way to improve climate adaptation is to target solutions to barriers at every level of government (Juhola, 2016; Biesbroek, 2014). Therefore, this thesis sought to identify some of the barriers that small municipalities in Newfoundland and Labrador face in the quest to implement climate change adaptation. Barriers were identified by both municipal representatives and non-government actors. The results are briefly explained below.

4.5.1 Funding

The issue of inadequate financial resources was one of the major obstacles that hinder adaptation planning and implementation. Almost all participants interviewed attested to this. For context, municipalities can generate revenue for development purposes; this financial resource is owned by the municipality and the municipality can decide what to do with it. Municipalities under study derive their own revenue sources from residential taxes, and services such as issuing building permits. According to participant 1:

> There's property taxes, so essentially residents in Deer Lake pay a percentage of the value of their house every year, so that's how the town makes money and that's the fundamental revenue, but there are other ways that the municipality gets revenue like for example through building permit.

Although these municipalities have their own revenue resources, such resources are insufficient to make significant and substantial infrastructural investments. Their tax bases are small, and the tax rate is limited for economic and political reasons. One may argue that, increasing tax rate could increase revenue for climate change infrastructure, however, it should be noted that increasing tax

rate discourages work, savings and investment which needed to improve the municipal economy (see Gale, & Samwick, 2014). Municipal representatives mentioned that climate adaptation and green initiatives require large investments, which they lack the funding to undertake, thus preventing them from initiating adaptation. This was echoed in a statement by Participant 4:

> I guess the primary challenge is funding greener initiatives …. the evolution of climate change is exceeding the technology that is available, so trying to keep up with what's current is very difficult because there's so much new technology coming out almost on a daily basis which require a lot more funds to keep up.

Moreover, this thesis acknowledges that municipalities derive all their authority from the provincial government. As a part of this administrative structure, the provincial government provides financial support to municipalities to undertake adaptation and deliver other municipal services. However, according to participants, over the past few years, the province has been financially challenged, which now pushes municipalities to rely on federal support, which is often restricted to certain infrastructural development such as roads, bridges. Again, participants 5 stated that "it's just unfortunate the funding that we received from places like the federal government usually stop at the plan stage and they don't extend onto the action or implementation stage." This funding issue makes the municipalities under study resort to reactive management of climate impacts, which requires less money at once and focuses on short-term impacts, rather than embarking on proactive management, which requires larger up-front investments but can solve longer-term problems (and is more cost-effective over time).

4.5.2 Human resource capacity

Across the participating municipalities, NGOs, and consulting firms, participants emphasized inadequate human resources at the municipal level to undertake adaptation whilst running the day-to-day. The case municipalities typically had two staff members who would

commonly be involved with adaptation issues. It was either a town manager and clerk, a town manager and planner, or town manager and public works superintendent. No case municipality had a staff member who was in charge of climate change. The participant (1) from Deer Lake mentioned that the Town had a climate change coordinator, which was a one-year contract. After the end of the contract, there were no funds to hire another person to take up the position. The above examples show how, for small municipalities, climate change adaptation is usually something that must be added on to general management and planning rather than being taken care of by dedicated staff. This issue of human resource capacity hinders these municipalities from doing more in terms of adaptation planning and implementation. This was highlighted by one of the NGO participants (6), who said that:

> The main challenge that we see is the lack of capacity within small municipalities. We really see very few human resources available to the town. You often will see one town administrative staff and one town public works staff. So, there's really not so much to do with these two people, especially in terms of developing adaptation plans and implementing those plans on top of their regular daily tasks.

Municipalities are loaded with many tasks and responsibilities – from the implementation of provincial and federal policies and maintenance of provincial infrastructure to providing services for their community members. Therefore, there is "little capacity to look at the processes and steps involved in developing an adaptation plan, unlike larger municipalities who have specialized staff for the purpose of climate change" highlighted by a participant from non-government organization. Although, there are non-government organizations and private businesses in the province, study municipalities engagement with these partners were low due to the inadequate human resources to search for and engage them. This was evident from a statement from municipal employee 3, the participant stated that; "currently we don't have a person on staff just to deal with climate adaptation to research on stakeholders and also engage them."

4.5.3 Inadequate political interest and community awareness

Some of the participants acknowledged that climate change adaptation needs to be part of municipal planning. However, there was variation among municipalities when it came to the relative importance of adaptation in comparison to mitigation. Mitigation has gained a lot of prominence at the municipal level. This was partly due to inadequate funding at the municipal level to fund adaptation and also lack of climate adaptation awareness on the part of the electorate, which means they do not elect council members who hold climate adaptation with high esteem. This was affirmed in a conversation with Participant 1, who stated that:

> ….municipality is accountable to its electorate, which are the residents of the town, so if there's an awareness in the electorate of climate change, that's going to translate to political action. Although I found the town really quite progressive in some ways, there's a portion of the population that sees climate change as a waste of money. Adaptation in the town is very small because people saw its consequences – riverbank erosion, flooding, coastal erosion, but still do not see the importance of climate adaptation due to lack of education about climate change its impacts.

Councillors who represent the values of the residents will put in effort to offer the infrastructure and services desired by the residents at the expense of climate adaptation. Throughout the study, it was evident that climate adaptation only represented a small priority in the case municipalities, among other divergent interests in municipal planning (Measham, 2011). A participant from a government agency in the province mentioned that most municipalities have council members older than the median age in the province. Such people may not necessarily place a high priority to climate change adaptation. the participant further stated that it is difficult for these older folks to accept new changes (e.g., technology) that come with climate change, which manifests as a significant challenge in smaller municipalities, which may desperately need to take advantage of new technology.

4.5.4 Information constraints and inadequate technical knowledge

A key observation from the interviews across the three municipalities was inadequate technical expertise in the area of climate change. As stated above, small municipalities are managed by very few staff members, which means each person has multiple responsibilities. For instance, a town clerk may be tasked with adaptation; however, this person does not necessarily have the necessary or relevant skill set. These municipalities often rely on external expertise, such as climate change coordinators at the provincial or federal level. Information specific to climate risks in the jurisdictions of these municipalities is limited. There are instances where the province undertakes floodplain zoning, climate projections, sea-level rise projection, or other impact measurements and predictions, but there may be no expertise at the municipal level to interpret such information, translate it into action, and make citizens aware of their vulnerability to such impacts. Related to this, even though funding opportunities exist, and municipalities are aware of this, they do not necessarily have the expertise to apply for such funding, especially given how competitive these opportunities are. A participant from a consulting firm highlighted that these small municipalities struggle with funding applications because they do not know the language to use, do not have much time, and do not really have the knowledge and background context that the funding agencies look for in an application, which limits their chance of success. One interesting comment from a municipal representative was that they usually apply for funding with the help of consultants who get paid for their services. Therefore, the municipality sometimes ends up worse off when the application is not successful, but they still paid a consultant.

4.5.5 Poor infrastructure designs

This barrier towards achieving climate adaptation at the municipal level was raised by the two consulting firms interviewed. Infrastructure is designed to be beneficial and sustainable over a certain time space (shelf life)—however, there may be poor physical planning and design for infrastructure in municipalities, due to either technical or non-technical factors. Participants 7 & 8 said some municipalities continue to face flooding issues even though they constructed culverts to manage a high amount of stormwater, because the incorrect positioning of the drainage systems prevents it from accumulating much of the water; hence they experience runoff and community flooding. Another point raised was that such municipalities have lots of old infrastructure that is all crumbling at once, and it is challenging to find a holistic approach to replacing or maintaining these structures.

4.6 Suggested remedies/solutions

To achieve successful implementation of climate adaptation in small municipalities in Newfoundland and Labrador, participants suggested the following approaches that the province, together with municipalities, private partners, consultants, NGOs, and the federal government, can adopt to counter some of the barriers explained above.

4.6.1 Regional government system

Most of the participants suggested that the challenges discussed above can be addressed with increased capacity that would come from a regional level of government, which the province currently lacks. Having a regional government mechanism allows for dozens of small and medium municipalities and other rural homeowners in different regions to amalgamate into larger “regional

municipalities" at a regional level of government between municipal and provincial (i.e. while maintaining their own governance structures at the local level). By so doing, they can then diversify their staff and provide a range of professional services that assist with making better decisions, and that means that a range of greater range of services is possible. Such a system also provides the avenue for municipalities to engage additional staff who could focus much on specific climate change issues and tackle all problems related to it, together with funding applications. Moreover, having a regional government system broadens the tax base of that municipality, allowing the municipality to generate further revenue resources that can be used to fund projects without relying heavily on the provincial and federal governments. If the province were to adopt such a system, the issues regarding human resource capacity and technical expertise could be addressed. However, regional government system is major change which requires comprehensive reforms, consultations, and agreement among and between cities and towns and changes about that may take a long time. This was evident as a government agency participant (9) stated

> We have been advocating for some kind of regional government to be brought into Newfoundland and Labrador now for over a decade and you know this is a long standing as it's now actually getting some attention because the current provincial government administration shall we say has been seriously engaging the conversation around regional government pretty much.

Häußler et al. (2021) and Slack & Bird (2013) suggests regional government system as a promising approach to solve some of the climate adaptation issues in small municipalities. According to both studies, a regional government structure provides certain benefits such as a stronger economic development, broadened tax base which promotes regional municipalities' ability to undertake adaptation and other services and provides an opportunity to deliver local services that benefit a large number population.

4.6.2 Streamlining access to funding

Participants suggested that the federal and provincial governments should make funding more accessible to them. They emphasized easing federal government restrictions on some of the funds allocated to municipalities to enable municipalities some form of ownership regarding using such funds. One of the participants proposed that the federal government should make adaptation a government priority area that municipalities can more easily get funding for. For instance, the federal tax fund available to municipalities has over 18 projects that are eligible under this fund with no project on climate adaptation related activity (see Government of Canada, 2021). They further postulated that such an initiative would encourage municipalities to incorporate adaptation in municipal planning. The Federation of Canadian Municipalities has been a great resource in terms of federal funding and expertise for municipalities in the province and across the country. This was echoed by a participant statement that,

> Federal government are streaming money through the Federation of Canadian municipalities programs, so it is important for municipalities to engage in such programs. There are also opportunities to engage in programs that may be provided by the federal government departments for which municipalities may or may not be eligible applicants, but they can oftentimes be partners to other eligible applicants

The federal government should enhance the flow of resources coming through the FCM, as well as make other funding programs accessible and available to support small municipalities that do not have the human capacity and technical know-how to initiate adaptation. As mentioned above, municipalities may not be eligible to some federal funding, but non-governmental organizations and private businesses would be, so it is very key for municipalities to engage the private actors in order to benefit from such funds. Additionally, there is the need to look outside of government by involving private partners in the planning process, thereby getting their interest to support the implementation of the plans. Municipalities should make good use of businesses and private

companies in their jurisdiction and not always focus on getting a grant and financial resources from the government (federal or provincial). Municipalities should consider public-private partnership to undertake certain projects. For instance, a municipality can go into agreement with a private company to take up some municipal projects. Municipalities should always consider benefits outweighing cost before entering partnerships not forgetting having insights to partnership engagement and structure (Margerum & Robinson 2015).

4.6.3 Education

Throughout the study, it was revealed that the views and opinions of residents played an important role in municipal planning and implementation of infrastructure and services. Almost all participants recognized the lack of climate change awareness among citizens, which contributed significantly towards their low interest in climate adaptation. It was then suggested that residents should be educated on the climate change topic and the impacts that they are vulnerable to. Moreover, when residents are given information relating to risks of climate change, they are more likely to be interested in taking action and hence may elect representatives who take climate adaptation seriously. This could bring climate adaptation to the top of the local government agenda (see Munaretto et al., 2014; Dannevig, Rauken, & Hovelsrud, 2012). Information on climate change adaptation can be disseminated to residents by holding public engagement and participation sessions, which are vital in implementing adaptation. When residents are made aware of the risk that climate change poses to them, they will be willing to support the municipality's adaptation actions and may even change their own lifestyles to contribute to adaptation (see Jacques, 2006). Furthermore, small municipalities in the province can take advantage of the University to educate people on measures to cope with the changing environment and benefits that the municipality will enjoy due to their cooperation. Municipalities can organize community

durbar and invite university lecturers with knowledge in climate change to educate community members on the need and how to adapt.

The chapter has explored the climate adaptation impacts, measures and process that study municipalities employ in adapting to climate change. Moreover, the concept of MLG and barriers were reconnoitred. Municipalities impacts and measures that they adopt to reduce the impacts of climate change were discussed. Furthermore, the chapter elaborated on participants views on the importance of MLG. As discussed, most participants saw MLG as a system that can provide a means to achieving adaptation goals in municipalities. They posited that, the participation of other levels of government and non-government entities in adaptation was helpful. However, municipalities could probably do more if they were given some level of autonomy and funding. The chapter also presented on participants opinion on the challenges that they encounter in adapting to climate change and subsequently presenting on the solutions that they (participants) suggested to combat the barriers they mentioned. The next chapter is the concluding chapter, that present a summary of the finding from the data collected and some more practical solutions or recommendations that municipalities can consider that were not proposed by participants.

Chapter 5: Conclusion

5.0 Introduction

This chapter is the final chapter of the thesis. It primarily provides a summary of findings. It continues to elaborate on practical recommendations that municipalities can adopt to implement adaptation which were not mentioned by participants. Finally, it presents study's contribution to academic literature and proposes areas for further research.

5.1 Summary of findings

The thesis explored the municipal planning and implementation of climate adaptation by specifically looking into the various barriers that small municipalities in Newfoundland and Labrador encounter in implementing climate adaptation. Three small municipalities from the western part of Newfoundland were studied. The study explored various issues surrounding climate change adaptation and mitigation, as well as the general management of municipalities, to address the research questions. In all, four research questions were answered to achieve the overall objective of the study.

The first research question was to identify the processes that small municipalities in Newfoundland usually follow to plan and implement adaptation. Results were discussed and derived from both secondary and primary sources of data. The secondary data were obtained from official documents such as municipal plans, climate change reports, and provincial articles on climate change. Interviews were conducted to gather primary data on municipal climate change impacts, measures taken so far, and the steps municipalities took to implement those measures. At the end of the study, the researcher was able to identify some of the climate change impacts

experienced by the study municipalities and measures undertaken to curtail or prevent such impacts. Examples of these impacts were coastal erosion, flooding, storm surges, and riverbank erosion; measures undertaken were riverbank stabilization, installation of armour stones at the beaches, and expansion of infrastructure such as culverts to accumulate a large amount of rainfall. The findings regarding this research question showed that climate impacts experienced differ among municipalities. Although there were some common impacts among municipalities, their causes were different. For instance, Deer Lake and Stephenville experienced high groundwater levels, but different determinants caused this impact. Deer Lake's groundwater level was caused by a high level of the deer lake during spring, while extreme rainfall events caused Stephenville's groundwater level. This indicates that tackling climate change requires a different approach in each municipality (Mimura et al., 2014).

After identifying these impacts and measures, the researcher probed further to explore the various steps that the municipalities followed to implement those measures. Indeed, the findings revealed that there was no defined process or steps to implement adaptation (see ICLEI, 2010). No case municipality had a climate adaptation plan spelling out what they are doing in terms of adaptation. However, two of the municipalities (Stephenville and Port aux Basques) studied had a climate action document. The main focus of the climate action document was on mitigation – actions outlined in the document aimed at achieving greenhouse emission targets. Moreover, as at the time the interview was conducted, the other case municipality, Deer Lake, was working on a greenhouse emission inventory. This is to say that less attention is given to climate adaptation than mitigation in these municipalities, which confirmed Whyte's (2013) submission. According to Whyte (2013) municipalities across Canada and nations' efforts towards climate change have primarily focused on climate change mitigation, with less or no policies on climate adaptation.

Due to the lack of adaptation plans, these municipalities react to rather than plan for the impacts of climate – responding to climate impacts as they occur.

The second, third and the fourth research questions were centered on identifying factors that hinder adaptation in small municipalities in Newfoundland and Labrador, as well as potential solutions to these challenges from participants. Furthermore, the researcher also explored the concept of multi-level governance for climate change to ascertain perceptions of the concept among small municipalities. Findings regarding these research questions were also presented in Chapter 4 of this thesis. Results were obtained from interviews with three municipalities, some consulting firms, and NGOs.

Findings from the second research question revealed that municipalities were aware of the MLG concept. From the responses gathered, there was a direct relationship between the province and municipalities. This is exemplified by the fact that municipalities often reached out to the provincial government for support to fix problems caused by climate change. Although there were federal engagements, the provincial-municipality engagement was more pronounced, likely due to the fact that municipalities derive their power from the provincial government (Fowler and Siegel 2002). One observation that the study made was that municipal staff members do not have enough time to research and recruit private businesses that they could partner with to implement adaptation which resulted in inadequate or less collaboration. Besides, the engagement of NGOs like Conservation Corps NL was limited to assisting these municipalities with problem identification and recommending actions that the municipalities can implement, without being able to support the municipalities through the implementation process. This was a result of limited funds to support implementation. Two municipalities (Stephenville and Port aux Basques) were part of the Partners for Climate Protection program offered by the Federation of Canadian Municipalities in

collaboration with ICLEI. As part of their participation, they were able to produce climate action plans through the support of experts in the program. Also, the study revealed that municipalities do not have the autonomy to implement certain development action due to development objectives and goals set at the provincial level. Municipalities must therefore try as much as possible to align their goals and objectives to that of the province.

This study identified some of the barriers to climate adaptation among small municipalities in the province. Examples of barriers identified were financial constraints, inadequate human resources, lack of awareness, and insufficient political interest. These barriers identified were not substantially different from what is already in academic the literature (lack of information; institutional limitations and limited financial and human resources), especially that concerned with small municipalities (see Bednar et al., 2018; Campos et al. 2017); however, the extent to which these barriers affected the implementation of adaptation as well as the degree of its impacts for small municipalities were intriguing. All three case municipalities had only two staff working on climate change alongside other activities at the municipality. One of the barriers that was not indicated in the literature was the poor design of infrastructure. The study revealed that small municipalities suffer from poor infrastructure design to meet the changing climate demands, which affects them in achieving adaptation goals. This study also found that, the study municipalities focused on mitigation more than adaptation, partly due to the fact mitigation funds were easily accessible to them. Participants also identified some solutions to counter the barriers identified, which is presented in section 4.6. See the table below for summary of major findings

Table 5 Summary of main findings

Research question	Main findings
1. What are the processes that small municipalities follow to implement climate change adaptation?	• Impacts experienced were different among municipalities and so were the measures taken to minimise them • Municipalities did not follow any defined adaptation process unlike what was described in literature (see ICLEI, 2010)
2. What role does multi-level governance play in municipal adaptation?	• Direct relationship between provincial government and municipalities • Inadequate collaboration • Some provincial interference at the municipal level
3. What are the challenges small municipalities face in implementing adaptation?	• Financial constraints • Inadequate human resources • Lack of awareness and insufficient political interest • Poor infrastructure design
4. How can small municipalities address adaptation implementation challenges?	• Regional government system • Streamlining access to funding • Education and public participation

5.2 Recommendations

This section provides some practical recommendations that small municipalities in Newfoundland can employ to implement adaptation, ones which go beyond what was directly expressed by the interviewees. The recommendations provided here are all based in broader reflections on the findings and results discussed in the thesis, government documents, and other related articles used for the study. The recommendations are grouped into two main categories – municipal recommendations and recommendations for other levels of government, government agencies, and non-government organizations:

5.2.1 Recommendations for municipalities

- Small municipalities are already experiencing climate impacts; however, data collected and discussions had during the study recognize the importance municipalities give to mitigation – therefore, attention should also be shifted to adaptation since both mitigation and adaptation work hand-in-hand to combat climate change.
- Municipalities should look for other sources of financial support, especially from private investors either in their location or outside their jurisdictions with climate adaptation interests. Also, municipalities should engage in federal programs such as the Partners for Climate Protection program and Building Adaptive & Resilient Communities program in order to benefit from funding opportunities and a bounty of climate adaptation expertise.
- Municipalities should intensify public participation and engagement. Citizens will support and be part of implementation when they are involved in the decision-making process. Municipalities should have awareness programs to educate citizens on climate change impacts and how dangerous they can be when actions are not taken.
- Municipalities could review the role of regional development to determine if it would be appropriate. As discussions about regional government proceed, in the interim municipalities can engage each other and combine resources to, for example, hire a shared climate change adaptation coordinator who will support adaptation planning in the municipalities.
- Another observation made was the negative net migration among small municipalities in NL. Municipalities should try to establish job opportunities so that youth can remain in the communities. The youth can be passionate about long-term problem solving and also possess skills acquired either through schooling or apprenticeship; therefore, when the

youth remain in the communities, they can help the community through engaging in economic and social activities that are needed to promote growth in the municipality and as well contribute to solving problems.

- Small municipalities should engage MUN and vice versa. The University can serve as a researcher to look for programs available for small municipalities in NL regarding adaptation, funding opportunities, and how best to apply. For instance, municipalities can make use of the Office of Public Engagement Department at MUN (website) and other university programs such as the Environmental Policy Innovation Lab (website) to undertake municipal research. As well, there are internship opportunities in some programs through which students could support municipalities.
- Municipalities need to identify and support climate adaptation 'champions' – these are local leaders that push the agenda forward

5.2.2 Recommendations for other levels of government / government agencies / non-government organizations

- In the study, participants suggested the need for regional government mechanisms to help reduce the barrier of insufficient human resource capacity in small municipalities. The Municipalities Newfoundland and Labrador Association has been advocating for this change to no avail. This is attributed to the fact that small municipalities are unwilling to give up their names to be part of another municipality. There is, therefore, the need to continue and intensify the education on regional government systems. Communities should consider and appreciate the benefits of having a regional government and how it will positively affect their standard of living.

- The study found that there is some sort of goal setting from the provincial government regarding development pathways in municipalities. It is therefore recommended that the provincial government consider increasing municipal autonomy to strike a better balance between both provincial and municipal interests. For instance, provincial–municipal funding arrangements can be more open ended rather than restricted by provincial-level goals and aspirations. This change would allow municipal governments to better develop their communities based on local priority needs.

5.3 Contribution to literature and areas for further research

This study aimed to contribute to the existing literature on barriers to climate change adaptation in Newfoundland and Labrador. The results from the study are intended to contribute to knowledge advancement regarding climate adaptation planning and implementation among small municipalities. This was achieved using three small municipalities (Deer Lake, Port aux Basques, and Stephenville) to advance understanding of climate change impacts and adaptation practices in Newfoundland and Labrador, the least-populated province in Canada. This research confirms the necessity for an iterative adaptation process since it is difficult to predict future impacts of climate change (Someshwar, n.d; Town of Conception Bay South, 2020; Infrastructure Canada. 2006). It is, therefore, necessary for municipalities to consider processes such as that of ICLEI's (2010) practicable process that municipalities can adopt. In the literature, Graham & Mitchell, (2016), Aylett, (2014), Hanna et al., (2014) postulated MLG among larger municipalities have led to progress regarding climate adaptation because they are embedded in larger and stronger networks including private investors, research institutions, community-based organizations, not-for-profit organizations, and Indigenous groups which broaden their capacity and resources to implement more adaptation actions. This study, however, draws attention to low participation

regarding multi-level governance of climate change in small municipalities. This was partly attributed to their inability to attract private investors due to the small market size and researching to locate programs and climate change partners around or outside their jurisdiction. The findings from the study also emphasize the need for local government leaders to support adaptation. As indicated in the literature, political interests at the local level plays an important role in all decision-making at the municipal level, including climate adaptation (Measham et al., 2011); hence, the less interest in climate adaptation by leaders, the less attention given. The findings from this research also tends to support the claims made in the literature concerning the adoption of regional government system as a tool to contribute to building small-medium sized municipalities capacity to meet municipal goal either in adaptation or other development related projects (Häußler et al., 2021; Slack & Bird, 2013).

Although the study's objectives were met, evidence from the findings should not necessarily be used to generalize about climate adaptation for small municipalities outside of the study region; the adaptation context is different in different places. Therefore, a similar kind of research could be conducted in other regions in the province, perhaps using the observations of this thesis as a starting point. Also, a study directly comparing adaptation barriers for small and large municipalities would enrich understanding about the differences between the two, which could further provide appreciation for how to support small municipalities. Last but not the least, a study that focus on how provincial and federal agencies view MLG processes and how checks and balances in the granting systems are determined is highly recommended.

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