Adapting to climate change:

An analysis of Canadian residential housing developers

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Abstract

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Climate change amplifies a range of environmental risks such as rising sea levels, wildfires, and extreme weather events, and requires us to consider the resilience of existing and future buildings to these risks. The housing sector will be an important space for implementing emerging climate change adaptation policies and requirements. This intersection underscores the urgent need for proactive and innovative approaches to climate adaptation in the housing sector, ensuring long-term viability and resilience for Canadian communities in a changing climate. This study is focused on one of the key actors in the housing sector: private residential developers. It aims to better understand how developers perceive climate risks, their role in adapting to these risks, the barriers, and the opportunities they face in adapting their business operations. Semi-structured interviews were conducted to gain insight into how developers perceive the issue of climate change adaptation, their capacity to adapt to a changing climate and to validate interpretations through direct conversations. Additionally, a document analysis of publications by industry associations and company reports scrutinized how developers publicly report on their adaptation efforts. This research aims to establish a baseline understanding of the role Canadian residential developers are currently playing in designing and implementing adaptation measures, as well as their capacity to adapt to a changing climate. Results show that although many firms are implementing strategies and actions to address climate risks, there are no concerted efforts by the building industry to integrate climate adaptation into their business operations, due to varying degrees of willingness and capacity. With limited governmental leadership, guidance, and regulatory pressures to enforce the necessity of adaptation, for many, adaptation is simply not a

priority. Additionally, findings raise concerns that there is no formal definition of what constitutes “adaptation”, which may lead to urban green grabbing and green gentrification.

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Chapter 1: Introduction

As climate change impacts intensify, adaptation has increased in importance and policy visibility. Canada is already experiencing multiple types of climate change impacts, such as shifts in temperatures and precipitation, changes in snow, ice, and permafrost, limited freshwater availability, and changes in the oceans that surround the country (Government of Canada, 2019). Cities situated along the coastlines such as Vancouver, Halifax, and St. John's are more likely to face rising sea levels and increased storm surges. Many damaging consequences may follow from this such as coastal erosion, infrastructure damage, and increased coastal floodplain areas (Bakos et al., 2022). Extreme weather events have led to thawing permafrost in communities of northern regions, coinciding with temperatures rising at a rapid rate (Government of Canada, 2019). Consequently, additional hazards like increased forest fires and accelerated infrastructure degradation impact housing in these communities.

The economic impacts of these events are enormous. In 2023 alone, wildfires in British Columbia cost around $1 billion in fire protection and $750 million in insurance claims (Ness, 2024). In Québec, smoke from fires spread to a significant portion of North America for nearby provinces like Ontario, and the health system costs spiked to $1.3 billion within a week. Fires and flooding in Nova Scotia cost $165 million and $170 million in insurance payouts and losses. Beyond the financial costs of these catastrophic events, across the provinces, the health, well-being, and livelihoods were negatively impacted, and a total of 200,000 people were evacuated at some point during the year (Ness, 2024). In addition to reducing greenhouse gas emissions, climate change adaptation is crucial to adjust our lifestyles and both public and private infrastructure in response to a changing climate (Schipper, 2020).

The Government of Canada first began to engage with climate change as a policy issue in 1995 with the start of the *National Action Program on Climate Change*. This program focused on advancing climate science and identifying mitigation initiatives to reduce greenhouse gas emissions, and adaptation initiatives to prepare for future risks (Government of Canada, 2021b). Following the creation of this program, a total of 11 assessment reports led by Natural Resources Canada highlighted how Canadian communities, the natural environment, and the economy have been impacted by climate change (Government of Canada, 2021b). National climate change assessments serve to inform citizens and stakeholders about climate change risks and impacts and facilitate discussions on how to effectively address the challenges posed by climate change in Canada through both mitigation and adaptation efforts. For example, *Canada in a Changing Climate: National Issues Report*, published in 2021 describes how all types of communities will face climate impacts on infrastructure, health, well-being, culture, and economies. These past few decades of Canadian climate change research underscore the critical necessity of identifying and implementing adaptation options to reduce harms caused by climate change impacts (Government of Canada, 2021a).

1.1 Climate Change Adaptation in Canada

Given Canada's decentralized governmental structure, responsibility for climate change adaptation is distributed amongst multiple levels of government. Non-governmental actors (e.g. business enterprises, industry associations, non-profit organizations) and other public agencies like crown corporations also bring valuable knowledge and resources to adaptation (Henstra, 2017). Coordinating adaptation among different levels of government and organizations remains a challenge in Canada, as it requires careful planning and leadership. In an effort to address the multifaceted issues tied to climate change adaptation, provinces and territories have developed

and implemented their own adaptation strategies in addition to existing federal plans. Additionally, municipalities are increasingly adopting local adaptation strategies. Early adopters like Vancouver, Toronto, and Montreal, along with smaller municipalities such as Prévost, Orillia, and Oakville, created plans with the help of the International Council for Local Environmental Initiatives (ICLEI) through the *Building Adaptive and Resilient Communities* (BARC) program. The program helps to integrate a collaborative and comprehensive approach to addressing the impacts of climate change, creating and executing an adaptation plan, and safeguarding communities' well-being, property, and prosperity (ICLEI, 2023). Amongst the numerous solutions proposed, common ones include the integration and enhancement of green infrastructure, and the development of education initiatives (communications and programs) to raise awareness of climate change amongst the general population (ICLEI, 2023). Another illustration of Canada's decentralized governance can be portrayed through Quebec's land-use planning and adaptation strategy, which set an expectation that all metropolitan communities, regional county municipalities (RCM), and northern communities integrate climate change adaptation objectives into their territorial planning in 2023 (Government of Quebec, 2019).

On a large scale, Canada's *National Adaptation Strategy* (NAS) was released in 2023 and outlines the goals, actions, and targets that are being or expected to be implemented by the federal government. Integrating a plan that is both reactive to current climate impacts and anticipatory of future risks is crucial to ensure that appropriate actions are implemented today and for the future (Government of Canada, 2023, p.5). The NAS considers five issue areas: *Disaster Resilience, Health and Well-Being, Nature and Biodiversity, Infrastructure*, and *Economy and Workers*. The strategy identifies specific targets, objectives, and goals for each issue area. Targets are near-term actions, objectives represent the medium-term actions that are

expected to be implemented by 2030, and goals are the broader outcomes that are expected to be present by 2050 (Government of Canada, 2023, p.6).

One could argue that Canada is making efforts to integrate adaptation actions to prepare for current and future climate risks. However, critiques of the strategy highlight gaps between the written document and the actual implementation of these solutions/measures. According to Ness and Miller (2022a, 2022b), short-, medium-, and long-term goals are vague and unrealistic, there is limited Indigenous engagement, and a crucial step to monitor and evaluate the goals and measures is overlooked. Indeed, Craft et al. (2013) argue that Canada exhibits low policy capacity for adaptation in critical infrastructure sectors, meaning the institutional adaptive capacity to design and implement new governance structures and effectively operationalize them. Indeed, Canada is characterized by having a highly devolved institutional context of local decision-making. The responsibilities and competencies of local governments are derived from subnational (provincial) governments, indicating a decentralized decision-making structure (Lesnikowski et al., 2019). This decentralization has significant implications for climate change adaptation, as the federal government shares jurisdiction with provinces on environmental agenda-setting but chooses to exert minimal influence on local-level policy decisions (Henstra, 2017). Although adaptation has become an important concept in policy and planning, harmful events such as the Western Canada heat wave of 2021 clearly illustrate that Canada has a national adaptation gap—it is not prepared for the impacts of a warming and increasingly volatile climate (Ness & Miller, 2022a, 2022b).

1.2 Housing and climate change in Canada

Climate change will have a significant impact on the Canadian housing sector. Housing constitutes a significant portion of the built environment and can sustain damage from climate

change-related hazards like storms and floods (Barata et al., 2011). As argued by the Canadian Housing and Mortgage Corporation (CMHC) (2022a): “Climate change risks [are] increasing the rate of depreciation on existing housing and increasing maintenance costs, so housing costs rise.” (p.26). Moreover, their report suggests that the effects of climate change could disrupt the relationship between supply and demand in housing, with implications for affordability (CMHC, 2022a). Climate change-related hazards also affect both the livability and health of Canadian cities (Stroud, 2023). As a result, the desirability of certain highly affected neighborhoods may significantly decline. For instance, studies have shown that frequent heat waves make homes in affected cities less attractive, and shift population growth to cities with more moderate year-round temperatures (Barata et al., 2011). Toronto, Montreal, and Vancouver are among the major Canadian cities that will likely experience more frequent and intense heat waves due to climate change. Projections show that by 2040-2050, Toronto will experience around 66 days with maximum temperatures above 30°C, which will pose both greater health concerns and reduce the attractiveness of certain areas for residents (City of Toronto, 2024).

Another challenge that the Canadian housing sector is facing is a decline in housing valuations and increases in insurance premiums. For instance, the housing market in Ontario was evaluated pre- and post-flooding caused by extreme precipitation, and the results showed that there was 8.2% decline in the average selling price, 19.8% increase in the average days on the market, and a 44.3% reduction in the houses sold in Burlington, Toronto, and Ottawa (Bakos et al., 2022). Furthermore, insurance companies may raise premiums or refuse coverage entirely in high-risk areas, posing difficulties for homeowners in adequately safeguarding their properties (Sarra, 2021). According to the Insurance Bureau of Canada (2024), severe weather in 2023 caused more than $3.1 billion in insured damages. Catastrophic events like forest fires can

decimate entire neighborhoods, requiring homeowners to rebuild, and flooding can cause foundation damage, mold growth, and other costly structural issues. Additional costs are added given the extensive repairs and ongoing maintenance (Stroud, 2023). Overall, because of the potential for significant declines in property value around the country and limited insurance availability, homeowners are facing greater financial insecurity.

There are significant equity implications to these physical and financial impacts and examining the housing sector brings attention to the intersection of the housing and climate justice. The vulnerability of minority groups has been impacted by both the housing crisis and the climate crisis (Costa & Garza, 2022). Climate change significantly affects health and well-being, particularly impacting marginalized communities the hardest. For example, climate change can cause deterioration of housing and living conditions of impoverished populations, contributing to health issues among those most exposed to extreme weather (Kidd et al., 2022). Lower-income households, tenants, and unhoused individuals are more likely to experience harm to their well-being due to poor-quality and inadequate housing. This vulnerability is often due to a lack of funds needed to prepare for or recover from extreme weather events, or because of their total exposure to such conditions (Costa & Garza, 2022; Kidd, 2024; Sawyer et al., 2020). Unhoused individuals often spend extended periods outdoors and face additional dangers from extreme temperatures and air pollution. For example, during wildfires, they often lack protective equipment and have limited access to shelters with adequate air filtration systems (Kidd et al., 2024). Overall, there are interrelated tensions concerning the housing crisis and climate change. More vulnerable populations and communities are more likely to experience the effects of the housing crisis such as affordability, availability, and security issues, and they are also more

vulnerable to the effects of climate change, which could also affect affordability and health (Sawyer et al., 2020)

1.3 Research objectives and thesis organization

While a growing body of scholarship has examined the significant impact that climate change will have on the housing sector, there is limited research examining how housing developers themselves are engaging with this issue, or their readiness to incorporate adaptation measures into both internal and external practices, such as their portfolios, business operations, and development projects. This is a significant gap because private housing developers play a pivotal role in shaping the design, availability, and affordability of the Canadian housing landscape, in particular by building nearly all of Canada's new housing stock (CMHC, 2023). The objective of my research is to explore how private-sector housing developers are responding to climate change, and whether they are integrating adaptation into their portfolios and business operations. The questions I pose are as follows:

(1) Are private residential developers adapting to current and future climate change risks?
(2) How do private residential developers perceive climate change risks to their business or the sector overall?
(3) What barriers and constraints to adaptation do private residential developers identify?
(4) What is motivating private residential developers to undertake adaptation work?

In the following sections, Chapter 2 provides a literature review on climate change adaptation in Canada, divided into three respective sections. First, it examines the history of Canada's housing system to understand how adaptation is integrated in housing policies

emphasizing homeownership and housing developers. Second, it identifies enablers and barriers tied to adaptation which helps to understand what could facilitate or hinder organizations' attempt to integrate adaptation measures. Third, it explores the concept of organizational learning, including how and why organizations respond to global issues like climate change and the motivations behind their internal and external changes. Chapter 3 then outlines the methodology, detailing three methods: an online survey distributed among Canadian private residential developers and accompanying interviews to gather their views on climate adaptation, follow-up interviews to gain a more humanistic point of view from developers, and a document analysis of grey literature, including company reports and government publications, to see how companies publicly report on climate adaptation issues for their sector or company. Chapter 4 elaborates the manuscript of this thesis, containing the results, discussion, and conclusion of this research. Chapter 5 synthesizes findings in the conclusion and reflects on future research avenues.

Chapter 2: Literature Review

Climate change affects nearly every aspect of our lives and necessitates action to strengthen our ability to adapt to its consequences and protect ourselves and our communities from harmful outcomes. Although climate change mitigation remains a focal point of climate policy agendas, climate change adaptation is now considered a "second pillar" of climate policy, and essential for addressing the impacts of climate change and minimizing social vulnerabilities (Orlove, 2022). Projected increases in the frequency and intensity of extreme weather events and climate variability directly impact the typical operating conditions of major infrastructure (Government of Canada, 2021a). Over the past decade, adaptation policies and strategies have been adopted at various governance scales, including global, national, regional, and local levels (Lesnikowski et al., 2017; Biesbroek et al., 2022). In November 2023, the Government of Canada released its first National Adaptation Strategy, which outlines federal goals and initiatives to respond to climate change impacts. The strategy puts forward 73 actions, including new federal investments and initiatives related to flooding, freshwater conservation, supply chains, and security (Government of Canada, 2023). The Canadian housing sector will play a significant role in many of those initiatives, for example, in plans to retrofit existing housing and climate-proof future development (Ness et al., 2021).

This literature review will explore fundamental principles and focal points around climate change adaptation in the Canadian context. In the following sections, I will first analyze the history and evolution of Canada's housing sector to highlight critical moments that have shaped the contemporary housing sector and housing policies. Next, I will examine how the concept of adaptive capacity helps us think about the ways that organizations like housing developers can prepare and respond to climate risks and impacts as they supply a significant portion of the

housing supply in Canada. Finally, I will discuss how the concept of organizational learning helps to explain the mechanisms and motivations that lead organizations like housing developers to engage with climate change adaptation.

2.1 Adaptation, housing developers, and Canada's housing system

The Canadian housing system relies on private markets to supply, maintain, and exchange 95% of the country's housing stock (CMHC, 2023), and so private developers will play a critical role in the implementation of proactive adaptation measures. The structure and dynamics of the Canadian housing system are therefore key factors explaining why and how different actors in the housing system might engage with adaptation as an issue, as well as their preferences for specific adaptive actions.

Thinking about Canada's housing system as a particular "policy style" gives us a lens through which we can think about the evolution of the housing sector and the enduring influence of private housing developers in Canada's housing system. A policy style is defined as a customary set of processes or procedures for policymaking that form "tradition[s] and history which constrains and refines [the] actions and concerns [of governments]" (Howlett & Migone, 2018, p.137). Enduring policy styles are typically associated with an incremental pace of policy change (Lindbloom, 1959). Howlett (1999) characterizes the Canadian style of policy as *punctuated gradualism* defined by "periodic reinventions of structures and processes as issues of federalism, and other pressures in general to promote a process of slow policy innovation and reinvention" (p.146). This pattern of gradual reform, interspersed with examples of lofty promises that frequently fall short on delivery, is reflected in Canada's housing sector. There are various historical instances of the federal government attempting to address fundamental problems related to housing supply or affordability, but ultimately terminating policy programs,

withdrawing budgetary support, or delegating responsibility to lower tiers of government (J. D. Hulchanski, 2006; Suttor, 2016). The following section illustrates this pattern in the evolution of Canadian housing policy from the period of 1920 to today. It highlights two other key aspects of Canada's housing policy style: an enduring focus on expanding access to homeownership as the preferred type of housing tenure, and reliance on the private sector to supply, maintain, and exchange most of the country's housing stock.

Contemporary federal housing policy has its roots in 1919 when a wave of returning World War I veterans motivated the launch of the *Federal Housing Program,* which aimed to increase the stock of higher-quality housing to house veterans. This incentive aligned with national concerns regarding housing needs and accommodations (Oberlander & Fallick, 1992, p. 10). Although the *Federal Housing Program* resulted in the construction of 6,242 dwellings in 179 municipalities over four years, it failed to relieve housing shortages because it overlooked those who most desperately needed adequate housing: low-income families (Hulchanski, 2003; Oberlander & Fallick, 1992). Nevertheless, these early housing schemes illustrate the emergence of two roles for the federal government in the housing sector: one as a corrector of market failures, and a second as a promoter of housing construction and development from coast to coast (Oberlander & Fallick, 1992).

Government intervention in the housing sector increased during the economic depression of the 1930s, and housing construction was strategically positioned by the federal government as a way to encourage economic revitalization while satisfying an urgent social need for suitable, affordable accommodation (Chisholm & Hulchanski, n.d; Oberlander & Fallick, 1992, p.15). In 1935, the federal government implemented the *Dominion Housing Act* (DHA) (Hulchanski, 1986). This policy aimed to increase home purchases through residential mortgage lending. A

joint lending system shared between private lenders and the federal government was created, offering loans that covered 80% of the house's value on a 20-year amortization. Although only a total of 3,263 loans were granted during its lifetime (1935-1938), and it was widely deemed by scholars to have "inconsequential" and "unsuccessful" impacts (Belec, 1997; Hulchanski, 1986), its normative impact was much greater as it created a model for financing private homeownership that eventually became standard within the housing sector. In 1938, the *National Housing Act* (NHA) replaced the DHA. It replicated the joint-lending arrangements of the DHA; however, the number of loans rapidly increased due to improved lending conditions that allowed lower-income households to access loans (Chisholm, 2003, p.5).

In 1964, pivotal changes were made to the NHA to shift the emphasis of government funding towards urban renewal. The Canadian Mortgage and Housing Corporation (CMHC), which was founded in 1946 with the aim of "to stimulate private enterprise to serve as large an area as possible of the housing field, thus reducing the demand for publicly assisted housing" (Suttor, 2016, p.37) by providing non-market housing to returning World War II veterans. The CMHC was granted authority to provide loans to provinces, municipalities, or their agencies for public housing schemes, land acquisition, and servicing programs (Wade, 1986). The ownership of this non-market housing was granted to provinces, municipalities, or their agencies, which marked a transition from the previous model where public housing was co-owned with CMHC and broadened the scope of financial assistance for non-market housing (Oberlander & Fallick, 1992, p.56). In 1968, the *Canadian Housing and Renewal Association* was established with the purpose of uniting urban neighbourhood renewal, officials and community housing activists who were concerned with regenerating Canada's urban communities. The reformed mortgage system, the introduction of mortgage insurance, and a housing market predominantly serving the growing

middle-class majority marked significant changes (Chisholm & Hulchanski, n.d). By the end of the 1960s, after more than twenty years of housing legislation and new housing programs, many Canadians had experienced significant improvements in housing conditions and accessibility. However, the approach of accommodating low-income households and upgrading deteriorated inner-city areas through the construction of extensive public housing estates, coupled with urban renewal initiatives that involved demolishing central residential zones, faced growing public opposition and criticism over the displacement of low-income families from their neighborhoods (Oberlander & Fallick, 1992, p.60).

August (2022) argues that the late 1970s marked the beginning of growing inequality in Canada, which she attributes to the rise of financialization and neoliberalism. Palley (2007) describes financialization as the dominance of financial markets, institutions, and motives in the overall economy, shifting focus from industrial production to financial activities, where assets and risks are turned into tradable financial products. Neoliberalism is described as the ideology advocating for free-market capitalism, privatization, deregulation, and reduced government spending to drive prosperity (Peters, 2010). Many new programs were created in 1973 through amendments to the National Housing Act to increase mortgage activity in the private market and offer new measures to help low-income households (for example *Non-Profit Housing Assistance*, *Co-operative Housing Assistance, Neighbourhood Improvement Program* (NIP)*, New Communities Program)* were terminated as the country sank into an economic recession that triggered sharp increases in unemployment rates (Suttor, 2016). Mortgage interest rates soared abruptly from 11 % in 1979 to 21 % in August 1981, which exacerbated already existing housing problems related to very low vacancy rates, scarcities in unsubsidized private rental construction, and high costs in single-family housing (Oberlander & Fallick, 1992, p.65). In response to public

pressure, three temporary federal programs were implemented to aid middle-income households (Begin, 1999). The first initiative, *The Canadian Home Ownership Stimulation Program*, facilitated homebuyers in acquiring grants. The second program, *The Canada Mortgage Renewal Plan*, supported homeowners in covering the portion of their mortgage and property tax that, due to mortgage renewal at higher interest rates, led to payments exceeding 30% of their income. The third program, *The Graduated Payment Mortgage Plan*, assisted homeowners in lowering their monthly mortgage payments.

In the 1990s the federal government embraced fiscal austerity, and scaled back CMHC's low-interest loan programs that historically supported social and affordable rental housing (August, 2022). This shift brought about a significant decline in the annual production of social housing units across Canada, from 20,000-30,000 units in the 1970s to 1,000-2,000 units post-1994 (Kalman-Lamb, 2017). Lower-income Canadians became increasingly reliant on private rental markets. This policy shift was accompanied by two major developments: the creation of mortgage-backed securities (MBS), which are financial instruments supported by separate groups of mortgages that carry insurance protection as a means of leveraging individual mortgages to increase liquidity in mortgage markets, and the creation of Real Estate Investment Trusts (REITs), which are organizations/companies that acquire and/or finance income-producing real estate across various sectors, allowing individuals to invest in large-scale, diversified property portfolios without directly owning or managing them (Autorité des marchés financiers, 2026; Mortgage-Backed Securities Issuer Association, n.d). Initially, in the early 1990s, REITs were predominantly utilized for acquiring commercial real estate, including retail plazas, office spaces, and office parks. Over time, they diversified their investment portfolio to include hotels, long-term care homes, and multi-family residential properties (beginning in

1997), storage facilities (in 2007), health-care properties (in 2010), industrial-only properties (in 2013), and automotive properties (in 2016) (August, 2020). Overall, the total assets in Canadian REITs grew from $80 million in 1993 to $75 billion three decades later. In private rental markets, both the deregulation of rent control and the introduction of vacancy decontrol (landlords increasing rent prices to "market prices" when tenants voluntarily vacate their units) created lucrative incentives that developers rely on to capitalize their assets (August, 2022).

Private developers now provide the vast majority of new or redeveloped housing stock and are the essential actors within the Canadian housing system. Coiacetto (2001) describes the basic strategy that guides the sector, which involves "searching for and adding value to, under-valued sites in accordance with an overall corporate strategy of adding value to undervalued assets. In other words, "cheap sites [are] sought out" (p.54). August (2020) argues that the new generation of "[financialized landlords] have new powers to develop sophisticated operating platforms, make large portfolio acquisitions, access cheap financing, and capitalize on economies of scale in new ways harmonizing property management, bulk purchasing, and investing in costly 'repositioning' (upgrading, refurbishing, and retrofits) both to save money and remake buildings for a luxury consumer" (p.978). Ultimately motivated by a profit-maximizing logic, developers typically aim for double-digit returns on new projects (Fields 2017; Fields 2019).

Experts hold mixed opinions about the effects of financialization on housing affordability and accessibility. On the one hand, the CMHC (2023) argues against assuming that private ownership of rental housing is "detrimental to affordability." They recognize the key role of the private sector in supplying housing in the country. Given the ongoing housing crisis, purpose-built rental housing is required to fill part of the gap with the help of the private sector and cannot assume and generalize bad behaviour among private developers. They further argue

private investment in housing can be part of the solution to the affordability crisis if it's properly regulated and bad behaviour is dealt with (CMHC, 2023). On the other hand, critics argue that the financialization of housing constitutes one of the drivers of unaffordability since mortgages, houses, apartments, and shelters necessarily become commodified and valued principally as financial investments to generate profit for investors (August, 2022; Farha, 2022). Negative impacts on affordability are not evenly distributed, as Farha (2022) points out; the financialization of housing particularly affects "marginalized groups (those who are low income, Indigenous, racialized, and disabled)" (p. 4). A recent survey highlights that 33% of Canadian tenant households spend more than 31-50% of their budget on rent, and close to half of working renters do not have backup savings for a month (Rentals.ca, 2025). These scholars argue that Canada is experiencing a housing price "bubble," which is increasing the financial burden of housing on both owners and renters and making homeownership unattainable for a significant number of households in the long term (August, 2022, p.11; Kalman-Lamb, 2017; Walks, 2014).

By the late 2010s, concerns about a growing affordability crisis in Canada resulted in the adoption of Canada's first *National Housing Strategy*, which recognized safe and secure housing as a human right and introduced a series of policy initiatives like the *Housing Accelerator Fund*, *Federal Community Housing Initiative*, and a *Federal Housing Advocate*. The *Housing Accelerator Fund* was a financial incentive offered to local governments to increase housing supply and support the development of low-carbon and resilient communities (Government of Canada, 2024b). The *Federal Community Housing Initiative* offers funding and support to both housing providers and low-income tenants (Government of Canada, 2024b). Financial aid to renters through *rental assistance*, a stream that covers 30% of the gross monthly income of a household receiving assistance, plus the occupancy charge. As for housing providers,

Transitional Funding aims to cover 24 months' worth of operating costs after the expiration of federal agreements (CMHC, 2021). As the CMHC (2021) states: “The initiative supports federally administered community housing projects reaching the end of their operating agreements from past social and affordable housing programs.” In February 2022, Marie Josée Houle was appointed as the *Federal Housing Advocate.* The position was created to provide a “human rights-based” approach to housing and serve as an intermediary, engaging with members of vulnerable groups to highlight ongoing national concerns, which include homeless encampments and the lack of safe housing in indigenous communities (Government of Canada, 2023). Houle was reappointed in February 2025 for a second mandate, this time with 50% less funding than her first mandate and current funding expected to expire in March 2026 (Canadian Human Rights Comission, 2025). Many initiatives and funding streams highlight a more active engagement from the federal government like in the 60s and 70s. However, one could question whether this reflects a fundamental shift in federal engagement or merely a lofty promise that ‘punctures’ the gradualism of Canada’s housing sector.

Overall, the concept of policy styles is useful for understanding the development of the housing sector and its dominant policies over the last century. Despite a general belief that the government should be involved in housing matters, low federal spending coupled with a lack of engagement and cooperation has pushed lower-tier governments to become more involved in (particularly non-market) housing production (Carroll & Jones, 2000). A combination of homeownership support, market regulation, and a limited role for the government in correcting “market failures” related to housing affordability are the foundational ideas that underpin housing policies in Canada (August, 2022; Kalman-Lamb, 2017; Oberlander & Fallick, 1992). Despite periods of heavier federal investment in social housing, private actors are by far the

biggest providers of new housing, and they operate under a market logic guided by profit maximization and property valuation. As Suttor (2016) points out: “Canada clearly fits the liberal-welfare regime type with low social spending. In such regimes, it is said that social housing is residual and that housing is provided almost exclusively through the market and access is directly determined by income” (p.6).

Kalman-Lamb (2017) argues that this “nexus of accumulation, wealth distribution, and housing allocation” (p.314) reveals how Canada’s housing sector places homeownership as a priority and is structured around the interplay of social dynamics that have bolstered the financialization of housing, as well as capitalist gain. Various tiers of the Canadian government attempt to address this without deviating from fiscal conservatism or the reliance on profit-oriented finance, developers, and landlords for housing provision. However, a growing segment of the population confronts unaffordable housing and heightened economic instability. Climate adaptation strategies may come to reflect this contradiction between a desire for housing inclusivity and ongoing dependence on capitalist market dynamics, the prioritization of homeownership, and the ongoing dynamic with actors like developers and landlords. This may also imply that the power of the private sector will be a significant factor in shaping these strategies and maintaining Canada’s housing stock. Subsidies to climate-proof and retrofit homes are readily available to homeowners through programs such as the *Canada Greener Homes Initiatives*, which provides grants valued at $125-$5,000 to homeowners looking to retrofit houses. Examples of such retrofits include home insulation, installation of heat pumps, and swapping energy systems (Government of Canada, 2024a). Past research has suggested that, on the whole, real estate appraisers tend to be followers rather than leaders in addressing sustainability issues and adopting sustainable practices (Rahman et al., 2017). This trend appears

to be shifting among some private developers, as a growing number of real estate developers are adopting sustainable building techniques and developing projects in neighbourhoods that have recently undergone or are undergoing greening processes, intending to tap into the market for (perceived) environmentally friendly urban development projects (Gould and Lewis, 2017).

On a broader scale, cities are also looking for greener and more sustainable solutions to adapt to the ongoing effects of climate change. A growing body of literature frames *urban greening* as a beneficial solution to reduce health inequities and enhance mental health among low-income urban and suburban residents (Mitchell et al., 2015; Thompson et al., 2016). Besides the well-known environmental benefits of green spaces like residential greenery, gardens, playgrounds, and parks such as the reduction of urban heat islands (UHI), air pollution, noise pollution, and heat waves (Kruize et al., 2019), the integration of green spaces has additionally been shown to foster socialization while cultivating a greater sense of belonging and safety among residents (Thompson et al., 2016). Furthermore, a report published by the World Health Organization (WHO) highlighted several health-positive impacts such as perceived general health, perceived mental health and all-cause mortality, cardiovascular disease mortality, reduced prevalence of type 2 diabetes, and reduced adverse pregnancy outcomes (WHO, 2016). In essence, there are different avenues for building urban resilience through *urban greening*. The distribution of positive and negative outcomes varies depending on how they are pursued.

On the other hand, scholars have also characterized urban greening as a potentially maladaptive adaptation strategy that can promote green gentrification and often prioritizes already privileged socio-economic groups/communities, creating conditions for the displacement of minority groups and unequal access to green spaces (Kruize et al., 2019). Urban green grabbing is an expression of the intersection between urban greening objectives and

financialization. Rooted from Fairhead et al.'s (2012) concept of green grabbing, which focuses on the appropriation and commodification of land and resources, urban green grabbing refers to real estate developers who: "appropriate additional surplus value, extract rent, social capital and/or prestige through locating developments adjacent to new urban greening projects" (García-Lamarca et al., 2022). Scholars have noted that (mostly private) developers openly encourage and celebrate the increased property values that urban greening brings (Heckert and Mennis, 2012; Beuschel and Rudel, 2010). A Boston-based private developer expressed the belief that the transformation of an abandoned rail bed into a greenway would inherently enhance property values. They stated, "Without a doubt, I firmly believe that this transformation will raise property values simply because it changes something predominantly negative into something overwhelmingly positive (García-Lamarca et al., 2022)." Within the discourse of consumer- or investor-driven green grabbing, 'greenifying' a building has been shown to boost the appeal and the value of an asset. Moreover, urban greening initiatives are seen to counterbalance the negative aspects of specific areas, such as the persistent presence of vacant lots and environmental hazards (although exposure to toxins may persist despite greening efforts (Cole et al., 2021). Scholars note that urban planning and policy frameworks can serve to support this discourse. For example, in an attempt to "successfully brand themselves," both Copenhagen and Malmö have integrated environmental sustainability into economic growth strategies, which highlights how green place branding aligns with neoliberal urban governance frameworks (Garcia-Lamarca et al., 2021).

Overall, García-Lamarca et al. (2022) argue that urban green grabbing acts as a "fundamental prop" for both consumer and investor-demand related issues around the misconception that green spaces create incentives for more sustainable consumer behaviour,

wellness practices, and health. It is important to note, however, that urban greening does not necessarily lead to maladaptive outcomes. As previously highlighted, positive outcomes of urban greening include enhanced urban biodiversity, lower urban heat island effect, and neighbourhood beautification (Thompson et al., 2016; WHO, 2016). The literature on urban green grabbing, however, reflects how developers can simultaneously modify their practices in response to the challenges of climate change, while adopting business strategies that exacerbate neighbourhood inequalities. Urban green grabbing is a useful concept to identify how private developers extract additional value from urban land by positioning their projects within urban sustainability discourses, and the consumer and investor dynamics that surround it (García-Lamarca et al., 2022). The phenomenon of urban green grabbing represents the potential for profit-motivated adaptation. However, in the context of Canada's ongoing housing struggles, this risks worsening issues like housing insecurity and neighborhood gentrification (Planas-Carbonell et al., 2023).

2.2 Adaptive capacity of housing developers: enablers and barriers to adaptation

The main purpose of adaptation is to reduce vulnerabilities and build societal resilience to anthropogenic climate change (Nichol and Harford, 2016). Adaptation literature emphasizes that the vulnerability of a system, regardless of its scale, is determined by the exposure and sensitivity of the system to hazardous conditions, which reveals the system's ability, capacity, or resilience to cope, adapt, or recover from the effects of those conditions (Smit & Wandel, 2006). The notion of adaptive capacity is often interlinked with the themes of vulnerability and equity. Brooks et al. (2004), define adaptive capacity as: "[T]he property of a system to adjust its characteristics or behaviour, to expand its coping range under existing climate variability, or future climate conditions. According to Smit & Wandel (2006), adaptation, adaptive capacity, vulnerability, resilience, exposure and sensitivity are interrelated concepts that entertain a wide

application to climate change science. This is because a higher level of adaptive capacity can facilitate the implementation of adaptive responses while reducing the vulnerability experienced by those in the given area (Thomas et al., 2019).

In practical terms, adaptive capacity is the ability to design and implement effective adaptation strategies, or to react to evolving hazards and stresses to reduce the likelihood of the occurrence and/or the magnitude of harmful outcomes resulting from climate-related hazards (Brooks et al., 2004). Furthermore, an essential aspect of enhancing adaptive capacity involves drawing upon past experiences to effectively address present climate challenges and applying the insights gained to better prepare for future climate scenarios, including unforeseen events (Brooks et al., 2004). Scholars argue that 'overhauling systems,' such as infrastructure, is an intricate and resource-intensive undertaking that demands robust policy capacity (Smit & Wandel, 2006; Swanson et al., 2021).

Scholars commonly rely on the identification of enablers and barriers to assess the level of adaptive capacity within an organization, measuring factors that either enhance or impede its development. Multiple types of barriers (historical, political, financial, natural, etc.) can block or hinder the implementation of an adaptation action and consequently lower adaptive capacity (Eisenack et al., 2014). Although research has identified a general willingness to engage in climate adaptation solutions, scholars have highlighted a significant disconnect between government recommendations/policies and concrete actions made by actors and organizations (Barr & Lemieux, 2021; Ford & King, 2015; Lesnikowski et al., 2011, 2015). Greenwood et al. (2023) note several important barriers can impede adaptation action, such as the lack of resources and incentives for long-term planning, or a lack of knowledge related to climate change adaptation. Another common barrier is skepticism regarding the severity and urgency of

climate impacts. Local knowledge of technical, climate-adapted solutions is instrumental for organizational adaptation, but opportunities to harness this knowledge can be missed as a consequence of skeptical beliefs (Greenwood et al. 2023). In a study about adaptation among Norwegian developers and construction firms, researchers found that most firms had made few efforts at adaptation (Eriksen et al., 2009). Firms described similar types of climatic challenges and adaptation options in building practices, however, there were significant variations in adaptation responses chosen by different firms, even within the same region or municipality. Additionally, studies on residential property markets show that beliefs about climate change and confidence in government-led mitigation of impacts may result in differing price impacts where risks lie primarily in the future (Clayton, al., 2021a; Clayton, et al., 2021b). This results in inconsistent incentives for proactive adaptation efforts among firms.

Gupta et al. (2010) presented a more holistic interpretation of adaptive capacity suggesting the need to simultaneously consider its various dimensions. Scholars have helped to think outside of preconceived notions of enablers and barriers particularly in the context of institutional adaptive capacity as it overlooks the possible interconnectedness between the two. Institutional adaptive capacity represents the adaptive capacity of organizations as they are often synonymous with one another (Gupta et al., 2010). Six broader dimensions were introduced based on a thorough literature review and brainstorming session. Each dimension comprises its own set of criteria for evaluating whether institutions are structured to enhance the adaptive capacity (See Table 1). Collectively, these dimensions form the wheel of adaptive capacity, providing a comprehensive framework to evaluate and educate social actors on how their institutions impact various facets of adaptive capacity (Gupta et al., 2010). Moreover, the wheel

facilitates the identification of deficiencies and potential oversights in the process of enhancing adaptive capacity, fostering dialogue and opportunities for improvement.

Table 1: Adaptive capacity dimensions and criteria

Dimension	Criterion	Definition
1.Variety	Variety of problem frames	Room for multiple frames of references, opinions and problem definitions
	Multi-actor, multi-level, multi-sector	Involvement of different actors, levels and sectors in the governance process
	Diversity of solutions	Availability of a wide range of different policy options to tackle a problem
	Redundancy (duplication)	Presence of overlapping measures and back-up systems; not cost-effective
2. Learning capacity	Trust	Presence of institutional patterns that promote mutual respect and trust
	Single loop learning	Ability of institutional patterns to learn from past experiences and improve their routines
	Double loop learning	Evidence of changes in assumptions underlying institutional patterns
	Discuss doubts	Institutional openness towards uncertainties
	Institutional memory	Institutional provision of monitoring and evaluation processes of policy experiences
3. Room for autonomous change	Continuous access to information	Accessibility of data within institutional memory and early warning systems to individuals
	Act according to plan	Increasing the ability of individuals to act by providing plans and scripts for action, especially in case of disasters

	Capacity to improvise	Increasing the capacity of individuals to self-organize and innovate; foster social capital
4. Leadership	Visionary	Room for long-term visions and reformist leaders
	Entrepreneurial	Room for leaders that stimulate actions and undertakings; leadership by example
	Collaborative	Room for leaders who encourage collaboration between different actors; adaptive co-management
5. Resources	Authority	Provision of accepted or legitimate forms of power; whether or not institutional rules are embedded in constitutional laws
	Human resources	Availability of expertise, knowledge and human labor
	Financial resources	Availability of financial resources to support policy measures and financial incentives
6. Fair governance	Legitimacy	Whether there is public support for a specific institution
	Equity Responsiveness	Whether or not institutional rules are fair
		Whether or not institutional patterns show a response to society
	Accountability	Whether or not institutional patterns provide accountability procedures

Note: Table adapted from Gupta et al. (2010)

While the housing sector has been slower to adopt adaptation as a strategic priority and there is limited research on housing developer's engagement with adaptation, we can look at the scholarship on net-zero targets and emissions reduction efforts to identify specific examples of

barriers and enablers to climate action among housing developers. Net zero energy (NZE) buildings are considered a crucial strategy for reducing energy use and greenhouse gas emissions in the building sector, especially in residential settings (Godin et al., 2021). Implementation of these targets, however, faces challenges rooted in cultural, technical, and organizational governance (Godin et al., 2021). Culturally, resistance to change among developers and private entities stands out as a significant barrier, coupled with limited awareness and accountability for climate action. Technical challenges arise from a scarcity of qualified labour and experience, exacerbated by low confidence in energy efficiency (EE) and a dearth of training opportunities. In market-based housing systems, the absence of financial incentives and the presence of unclear and/or lax building codes and regulations have deterred voluntary uptake of mitigation efforts by firms (Godin et al., 2021).

While scholarship on adaptation barriers and enablers has grown and persisted in the adaptation literature, scholars like Biesbroek et al. (2015), and Wellstead et al. (2013) challenge their conceptualization, and argue that they tend to offer a ‘black box view’ on decision-making that presents adaptation governance as functionalist (the role/assigned function in maintaining a larger system or structure) and overly reductionist. Wellstead (2013) critiques Brown's (2009) vulnerability assessment of Ontario's Forest sector, for example, arguing that while the analysis emphasizes the factors contributing to forest vulnerability, it lacks a systematic examination of the operational dynamics of political and policy institutions. Furthermore, it does not determine whether these institutions are capable, under various circumstances, of effectively delivering climate change adaptation outcomes. These authors argue that the use of barriers tends to oversimplify and overlook the complex dynamics made in the process of collective adaptation, and portrays adaptive capacity in an over-static manner that cannot explain why adaptation

outcomes are successful or unsuccessful (Ford et al., 2017; Williamson et al., 2012). Biesbroek et al. (2015) argue that disciplines like political science have "moved away from notions of barriers to implementation as it became clear that the actions prescribed based on the identified barriers fail to solve the problems in practice" (p.2).

Another challenge with the notion of adaptive capacity is that it only reflects the potential for adaptation, however, adaptation is neither inevitable nor automatic even where adaptive capacity is high (Repetto, 2008). We can look to high-income countries that experience major disaster losses as an example of this. When Hurricane Sandy struck the northeastern part of the US in 2012, power and gas shortages were widespread and a total of 305,000 homes were destroyed (Blake et al., 2013). Adaptation readiness was introduced as a complementary concept to estimate the likelihood that adaptive capacity would be translated into tangible adaptation responses. Adaptation readiness is defined as "the extent to which human systems (e.g. nations, regions, businesses, communities, etc.) are prepared to adapt, providing an indication or measure of the likelihood of adaptation taking place" (Ford & King, 2015, p.509). Together, high adaptive capacity and adaptation readiness can create a strong basis for organizational action on adaptation, offer insight into the likelihood of short-to-medium-term adaptation action, and guide the allocation of resources to enhance preparedness for adaptation (Barr & Lemieux, 2021).

Overall, the literature on adaptive capacity remains contested. On the one hand, identification of enablers and barriers is useful to explain why organizations or governments undertake or fail to undertake adaptation (Berrang-Ford et al., 2021; Clayton et al., 2021; Eisenack et al., 2014; Fayazi et al., 2020; Godin et al., 2021; Greenwood et al., 2023; Williamson et al., 2012). On the other hand, focusing solely on adaptation enablers and barriers overlooks complex dynamics that characterize different governance or organizational contexts (Biesbroek

et al., 2015; Ford et al., 2017; Wellstead et al., 2013; Williamson et al., 2012). As Berkhout et al. (2006) states: “Organisations rarely adapt ‘autonomously’ since their adaptive behaviour is influenced by policy and market conditions and draws on resources external to the organisation.” The concept of organizational learning provides a useful entry point for explaining how organizations respond to externalities (Berkhout et al., 2006). The following section examines this concept in the context of adaptation.

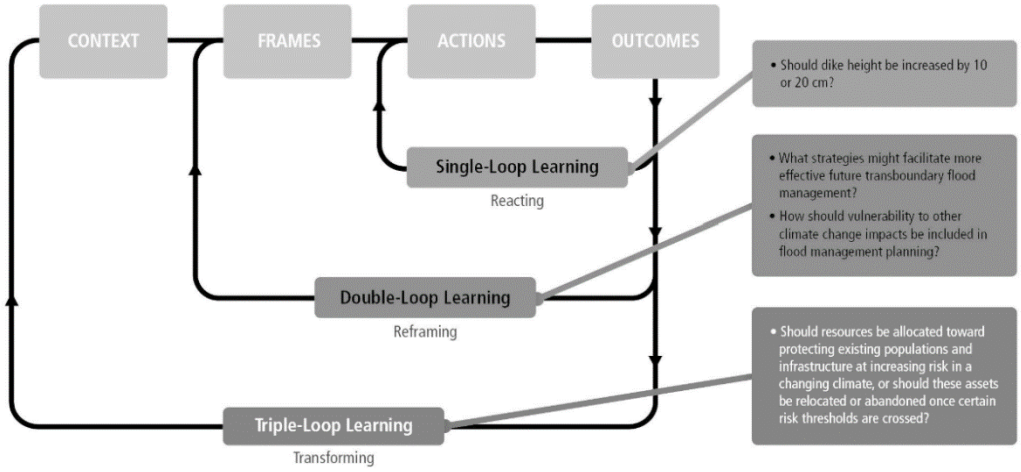
2.3 Organizational learning on adaptation

Climate adaptation requires the capacity and willingness to effectively manage external changes, foresee future developments, and consistently adjust internal processes accordingly. The concept of organizational learning is a useful entry point to understand how firms are changing their business practices in response to climate change impacts. Fischer et al. (2022a) point out that organizational learning is instrumental in strengthening performance and, in the case of the private sector, competitiveness. Furthermore, a large-scale literature review performed by Daddi et al. (2018) points out that organizational learning has helped to create a more collaborative and adaptive approach to climate change, specifically in managing climate change issues in the context of business opportunities, for example through business networks (Helgenberger, 2011).

Single-loop and double-loop learning are two influential models to measure the outcomes of organizational learning and are frequently employed in climate change adaptation literature (Leszczynska, 2012). Single-loop learning refers to corrective alterations applied to present policies or regulations to achieve a certain goal (Argyris & Schön, 1978). Double-loop learning involves reassessing and adjusting existing policies or regulations, where the distinction from single-loop learning lies in the extent of the correction. The difference here is that the modification influences an organization's fundamental norms, policies, and objectives (Argyris

& Schön, 1978). Although never explicitly introduced by Argyris and Schön, an additional loop was added by Tosey et al. (2012) creating the triple-loop learning. This concept reflects on the organization's overall structure, particularly its internal motivations and identity, as well as its interactions with the external environment (Easterby-Smith, 1997; Tosey et al., 2012). The figure below, taken from Turner et al. (2016), illustrates the difference between the three types of loops. In climate change adaptation, single-loop learning refers to organizations readjusting decisions to recognize an inappropriate response (Turner et al., 2016). Second-loop learning occurs when organizations reframe their approach to climate change adaptation, leading to new actions to ensure adaptation (Turner et al., 2016). Triple-loop learning involves a complete transformation in the organization's understanding and approach, changing the framing of the issue and the actions implemented for adaptation (Turner et al., 2016).

Figure 1: Single-, double-, and triple-loop learning as part of climate change adaptation



Source: IPCC, 2012

It is worth noting that several other learning processes such as learning in environmental governance and adaptive management, can be relevant to adaptive capacity. Learning in environmental governance refers to both " a process of acquiring, translating, and disseminating new information and knowledge among policymakers, managers, and key stakeholders […][and] also refers to outcomes, including changes in beliefs and behaviors among governance actors, knowledge, and capacity building and the adoption of new policies" (Gerlak et al., 2020, p.653) Adaptive management in the context of climate change adaptation refers to the "iterative process in which practitioners test hypotheses and adjust behavior, decisions, and actions based on experience and actual changes. These processes can be either active or passive; active adaptive management involves testing multiple options to determine the best strategy, while passive adaptive management requires selecting and implementing one option and monitoring to determine if adjustments are needed" (Gregg et al., 2018, p.260). Although these concepts are relevant to the greater idea of adaptive capacity and could be useful to understand how this specific group (private residential developers) is responding to climate change, organizational learning is less speculative in terms of the expected or current approaches to adaptation. Learning in environmental governance assumes that key actors have already put practices in place in relation to the specific environmental settings which will not necessarily be the case for the firms that will be considered in this research. As for adaptive management, Marmorek et al. (2019) argue that climate change adaptation and adaptive management would benefit one another if climate change adaptation principles and procedures are applied in current or upcoming projects. This again assumes that developers are currently or have already implemented climate change adaptation principles. Adopting this perspective may be speculative for the context of this research as it could assume that firms are engaging in climate change adaptation but are not.

Before reviewing contrasting perspectives on organizational learning, it is worth distinguishing between this concept and learning organization. Although they are often used synonymously, Smith (2001; 2007) distinguishes organizational learning as "an analysis of the processes involved in individual and collective learning inside organizations" whereas learning organization implies: "an action orientation and is geared toward using specific diagnostic and evaluative methodological tools which can help to identify, promote and evaluate the quality of learning processes inside organizations." In other words, organizational learning reflects both the activity and the process by which organizations learn and integrate knowledge. Over time, firms may evolve into a learning organization. Senge (2006) defines a learning organization as: "organizations where people continually expand their capacity to create the results, they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning to see the whole together" (p.8). It is crucial to distinguish these concepts as they reflect different things. For this research, looking at the processes and tools of organizational learning will be helpful to better understand how private residential developers are integrating climate change adaptation within their businesses. In fact, Organizational learning allows us to see adaptation as a dynamic process of continuous learning and adjustment that allows for ambiguity and complexity (Staber & Sydow, 2002).

The concept of organizational learning takes on many forms and has been used in many disciplines such as psychology and organizational development; management science; sociology, production management, and cultural anthropology (Easterby-Smith, 1997). This also means that the concept falls under different frameworks. The earliest contributions originate from the field of management science production, where the term organizational learning was coined through the interrelated processes of information processing and decision making in organizations. These

contributions aimed to aid organizations in navigating environmental changes by offering prescriptive managerial techniques (Brandi & Elkjaer, 2015).

Behaviorist studies contend that organizations engage in 'routines'—established rules, procedures, strategies, etc.—which are systematically employed in response to familiar situations (Argote, 2012; Berkhout et al., 2006). Cyert and March (1963) consider organizations as ‘adaptive systems.’ Their ability to adapt is rooted in their routines influenced by various elements such as form, rules, procedures, conventions, strategies, and technologies (Leszczynska, 2012). Organizations align their existing routines with the situations they encounter. Learning occurs through repetition (learning by doing) or, when encountering a new situation, through a process of exploration and deliberate adjustment of routines to fit the novel circumstances (Berkhout et al., 2006). In the context of climate impacts, some developers have restructured business routines based on changing climatic conditions and new regulations, however, firms have reported limited ability to process and interpret these signals because “they remain outside their normal operational routines and strategic planning cycles” (DiBella, 2020).

The cognitive perspective on organizational learning highlights how knowledge learning can help organizations acquire, understand, and internalize new information, skills, or insights. This involves the acquisition and assimilation of knowledge (often through study), shared information, and education (Argote, 2012; Fischer et al., 2022b). Within the context of organizational learning, the emphasis is on learning as a deliberate (not subconscious) process. As such, it can be both rationally planned and the result of continuous experimentation and re-evaluation (Argote, 2012; Fischer et al., 2022a, Fischer et al., 2022b; Holden, 2008). A noteworthy definition of organizational learning is "the evolution of an organization's knowledge through experiential changes" (Argote, 2012; Fiol & Lyles, 1985), encompassing both

declarative knowledge (facts) and procedural knowledge (skills and routines). Fischer et al. (2022b) note, however, that climate change is a multifaceted and dynamic issue that sometimes evolves faster than our formal knowledge moves, and as such it can be difficult to rely purely on formalized learning processes. They emphasize the importance of other types of learning, such as ability learning, life learning, and learning to learn. These types of learning imply utilizing skills that are developed through everyday experiences and personal growth such as observations and interpretation, acquiring knowledge through personal experiences, which helps to better understand our own mental model when faced with new information.

In contrast, organizational learning from a social constructivist perspective approaches the concept as an "institutionalizing process" (Huysman, 2002). This perspective emphasizes that knowledge acquisition of organizations is rooted in individual or local knowledge and transitions into collective knowledge. Additionally, this socially constructed knowledge shapes and is shaped by local knowledge (Huysman, 2002). Another term often used to describe this perspective is social learning theory, which further emphasizes the connection between socialization and learning. As Brandi & Elkjaer (2015) point out, socialization and learning are "inseparable entities" as these ensure an understanding of learning which reflects a form of participation in a social dynamic. Furthermore, learning in this perspective is considered "ubiquitous" and "unavoidable" as it is an action that is part of our daily lives (work and life in general) and extends beyond individual cognition to encompass processes of engagement and interaction. (Lave & Wenger, 1991). Although this perspective helps to draw out the processes underlying organizational learning, the social-constructivist perspective focuses more on understanding *how* knowledge and learning is constructed through interactions among individuals or groups, often raising questions about power dynamics and the relationship

between discourses and structures. In this thesis, however, I aim to establish a baseline understanding of housing developer's awareness of climate change risks and impacts, and their attitudes and engagement around adaptation. Consequently, I will draw from the behaviorist and cognitivist perspective of organizational learning as it aligns more closely with my research aims by looking at how organizations and the actors within them react to new information (i.e. on climate change risks and impacts), as opposed to analyzing processes of socialization and learning (Brandi & Elkjaer, 2015).

Berkhout et al. (2006) contend that organizational learning when observed, tends to take place in either of two ways: by repetition (learning by doing) or through a process of searching and planned modification of routines to suit new challenges. Uittenbroek (2016) identifies four self-reinforcing mechanisms that explain why organizations may develop new adaptation routines: complementary effects, coordination effects, learning effects, and adaptation expectation effects. Complementary effects are established through connections between resources and practices in routines. Climate change adaptation is mainstreamed if there is a synergy between climate adaptation and other objectives (Uittenbroek, 2016). Coordination effects typically occur when actors from different firms or organizations adopt and follow the same routine (Sydow et al., 2009). Over time, routines can become 'fixed' and 'inflexible,' and actors are solely compliant with the rules. In this case, actors mainstreaming climate adaptation often experience difficulties in coordinating with other actors outside of their organization. Learning effects are established through the familiarity of a routine. The more familiar actors are with a routine, the more it is effectively learned and applied. In this mechanism, actors integrate small iterations in attempts to optimize the routine which is referred to as exploitive learning (Sydow et al., 2009). Although this type of learning aims to facilitate and simplify their

understanding of tasks and values, Uittenbroek (2016) argues that actors may hyperfocus on these changes and overlook opportunities to innovate their practices and operations. Instead, they may conduct explorative learning. According to the author: "This kind of learning is necessary to explore routines that mainstream climate adaptation in the output and can also be considered effective and efficient so that it can compete with the dominant synergy." (Uittenbroek, 2016, p.165). Adaptation expectation effects are reflected when actors' preferences are altered to gain legitimacy for their actions (Sydow et al., 2009). In terms of mainstreaming climate adaptation, legitimacy should align with shared preferences to ensure agreed-upon practices.

Although organizational learning mechanisms may promote mainstreaming climate change adaptation within company routines, they may also pose a barrier. For instance, complementary effects may create too much reliance on resources and practices in the routine, and coordination effects may rely too much on strict rules structuring the routine and constrain people's ability to see new ways of doing things. As for learning effects, adjustments to the routine solely through exploitative learning may limit the possibility for major changes and innovation. Overall, reviewing these self-reinforcing mechanisms can aid in understanding different methods in which routines practice coordination and interaction.

Additionally, Berkhout et al. (2004) note that organizations only put effort into creating new routines when they realize that the current routines are ineffective or inadequate. For example, Berkhout et al. (2006) examine whether housebuilding and water utilities companies in the United Kingdom adopt new routines in response to the pressures of climate change. They observe that firm's adaptation responses tend to align with existing routines. Changes in management structure or practices thus tend to come about when organizations report that adaptation knowledge was already present in the organization. In other words, adaptation

measures were implemented when there was an already clear understanding of the concept and necessity of adaptation. For instance, technical directors of development companies could identify various practical measures to mitigate storm damage on construction sites. These included physical protection measures and changes in building techniques that could include greater use of off-site buildings. With the help of existing appraisal, risk assessment, and decision-making procedures, developers also incrementally adjusted their land-buying strategies in response to increased flood risk.

Common enablers of organizational learning include the integration of routines as previously noted, networking, as well as awareness and sensitization. Routines are useful for promoting organizational learning as it provides a foundation for consistency, efficiency, adaptation, and innovations for members. Networking within similar industries is recognized as a valuable catalyst for organizational learning. This is because companies in comparable sectors incentivize each other to improve environmental practices, fostering the exchange of knowledge and promoting learning. (Fischer et al., 2022b). Awareness and sensitization encourage collaborations amongst company members and spark innovation, for example, designing educational and training activities based on organizational learning can catalyze eco-cultural innovations and strengthen the processes behind a firm's ability to address climate change issues (Dieleman, 2013; Fischer et al., 2022b; Helgenberger, 2011).

The literature surrounding organizational learning barriers is similar to that on climate change adaptation barriers in that it recognizes barriers to be context specific and interdependent. There are also similarities in what types of barriers are discussed. For example, in studying organizational learning on adaptation in Swedish cities, Daddi et al. observe that low general acceptance of the need for climate adaptation amongst local developers and builders is a

common challenge for organizational learning (Daddi et al., 2018). This implies that local actors are skeptical about the issue of climate change adaptation and do not prioritize it within their business practices. Herrmann et al. (2017) describe barriers related to corporate knowledge, corporate (financial) resources, corporate objectives, corporate processes, collective knowledge, and corporate incentives. Corporate knowledge reflects enterprises' general knowledge about climate change and possible ways to adapt, while corporate (financial) resources represent the internal and external (i.e. private financing) funding that are available to implement adaptation measures. In this study, corporate objectives capture whether the enterprises integrate or do not integrate climate change adaptation. Instead, they may integrate climate change mitigation or safety-related aspects within their objectives. Corporate processes reflect the extent to which employees are involved and motivated to integrate adaptation measures in their routines. As for collective knowledge and corporate incentives, these imply the accessibility and quality of the information on climate change, climate change adaptation, measures, and financial incentives to implement adaptation and the existing legal provisions and political discourse surrounding climate change adaptation.

Critiques of organizational learning often revolve around its implementation challenges, theoretical underpinnings, and the (in)ability to evaluate its efficacy effectively. Firstly, critics argue that organizations often struggle to set clear and measurable goals about learning and integrating knowledge to improve performance (Smith-Milway & Saxton, 2011). For example, in a survey that was circulated amongst non-profit organizations, although 98 percent of nonprofit organizations gathered substantial amounts of information, one-third admitted to being incapable of effectively reflecting on and integrating it meaningfully into program activities (Smith-Milway & Saxton (2011). Another critique of organizational learning is whether it is an effective

process for capturing and sharing learning amongst employees. Easterby-Smith (1997) points out the difficulty in measuring and assessing learning within complex organizational structures, where tacit knowledge (knowledge gained through personal experiences) and informal learning (knowledge gained through daily experiences, interactions with others, and engagement with the environment) may not be easily captured. Furthermore, according to Prange (1997), another reason behind this critique is the lack of theoretical integration since research on organizational learning progresses nonlinearly. Finally, the discrepancy between individuals' professed beliefs and their actual behaviors, known as espoused theory versus theory-in-use, is often critiqued in this concept. Despite being committed to new ideas and practices, individuals frequently struggle to translate these intentions into tangible actions (Easterby-Smith, 1997). This has been said to undermine the overall credibility of the concept since individuals tend to resist acknowledging any inconsistency between their beliefs and actions, often reacting defensively when confronted (Argyris & Schön, 1978). Groups and organizations develop defensive mechanisms that impede questioning of the status quo and hinder recognition of underlying issues. Due to the abstract and metaphorical nature of the legitimacy concept, assessing and quantifying its validity remains a challenge. (Prange, 1997). However, Prange (1997) argues that the use of metaphors can be helpful to researchers to be more “sensitized to varying possibilities of interpreting the world” (p.25) which can help to frame organizational learning as a lens rather than a tool.

Overall, the concept of organizational learning provides a valuable framework for understanding the dynamic evolution of business operations. Adopting a broader perspective allows us to examine not only the how but also the why behind organizational changes, whether driven by external events or competitive pressures. Through this lens, organizations can

proactively adapt and innovate to remain resilient and competitive in an ever-changing environment.

2.4 Conclusion

In this literature review, I argue that private housing developers are an essential actor within the Canadian housing system as they provide nearly all new housing. Diving into the history of Canadian housing policies helps to understand the current housing system and how important actors like private residential developers are interacting with bigger issues that the housing sector faces. Government policies that reinforce financialization in the housing sector and maintain minimal levels of government support. Overall, our understanding of whether, how, and why these developers are engaging with climate change adaptation issues is understudied. I argue that the concept of organizational learning can help us to understand how and why developers integrate adaptation responses into their business operations and development portfolios. By drawing from the behaviorist and cognitive perspective on organizational learning, which focuses on understanding observable changes in behavior that happen through reinforcement and conditioning, I aim to gain a deeper understanding of why some developers are beginning to integrate adaptation actions in their practices and portfolios, as well as their motivations tied to these, while others are not. The following section describes the research design of my thesis, including my data collection and analysis strategy.

Furthermore, it is worth noting that within the context of climate change adaptation, different tiers of government are actively working to integrate effective policies, tools, and measures to ensure lasting solutions in the face of upcoming events. Given the decentralized nature of Canada's governmental structure as described in Chapter 1, each level is working independently to implement adaptive solutions. Climate adaptation strategies could reflect the

ongoing tension caused by housing unaffordability and the current economic crisis, the precedence of homeownership, and the ongoing dynamic with actors like developers and landlords. Consequently, this may also imply that the power of the private sector will be a significant factor in shaping these strategies and maintaining Canada's housing stock. The primary decision-making power lies not just with government bodies but also with private sector stakeholders as they are the ones who drive housing development practices.

Chapter 3: Methodology

The research design of this project adopted a qualitative methodological approach to gain insights into the positions, perceptions, and actions on climate change adaptation among private housing developers. First, I disseminated a nationwide survey to private residential developers who are listed as members of the Canadian Home Builders Association (CHBA) or the Urban Land Institute (ULI). This survey served as a tool for identifying and analyzing developers' awareness of climate change risks, their readiness to participate in adaptation measures, and the obstacles they foresee. The intention of the survey was to gain a comprehensive understanding of adaptation attitudes, priorities, concerns, and responses among private housing developers. Second, I conducted a document analysis to identify how developers reported on adaptation in public reports using a deductive coding protocol. Third, I conducted follow-up interviews with survey respondents to gain a more humanistic point of view on how developers are engaging with climate adaptation. I aimed to conduct between 10 and 15 interviews and completed 14 interviews. Once completed, they were transcribed and analyzed with a coding protocol to highlight recurring themes. By scrutinizing industry practices and responses, this multimethod approach enabled a triangulated perspective on climate adaptation within the private residential development sector. The study received ethics approval from the Concordia University Research Ethics Unit under certificate #30018192.

3.1 Survey via Google Forms

Surveys are useful tools to gain insight on participant's subjective experiences, narratives, practices, positions, and discourses (Braun & McEvoy, 2021). In the first stages of the research, I administered a survey with questions about developers' awareness of climate change risks, their willingness to engage in adaptation measures, any existing work on adaptation happening within

these companies, and the challenges they anticipate in undertaking adaptation. Prevailing sentiments from key actors and stakeholders in the residential development sector were captured. An online survey was disseminated to a total of 1,983 developers who are members of the Urban Land Institute (ULI) and/or the Canadian Home Builders' Association (CHBA). The ULI and CHBA provide contact information for their member organizations (accessible through a paid membership in the case of the Urban Land Institute (ULI)). That information, including company names and primary email contacts, was extracted into an Excel file. Companies without publicly available email addresses were excluded from the list of invitees. A total of 362 company contacts were collected for the ULI and 1,621 for the CHBA. The survey was made up of 28 questions, including both multiple-choice and open-ended questions, placed in a fixed and standard order for all participants. The open questions were intended to be used to gain qualitative insight into the perceptions and attitudes of developers, and the closed questions were be used to generate descriptive statistics about adaptive responses that are currently or expected to be implemented. The survey took a maximum of 30 minutes to complete and was conducted using Google Forms because it is a simple platform to use, widely available, and does not limit the number of responses that can be collected.

Since the survey was available online, an email containing a brief description of the study and an access link was circulated on December 14th, 2023. Initially, the deadline for the survey was March 31st, 2024; however, given the low response rate, the deadline was extended to June 1st, and the contact list was expanded as members of the Canadian Home Builders Association (CHBA) were added. Members specifically identified as "residential" developers and builders were selected as they are the target group for this research. See Appendix A for the email template that was utilized to invite participants to complete the survey. No incentives for

participation were provided to participants. The initial invitation email included details on the research objectives, design, and survey content, clearly stating that participation was voluntary and that participants could opt to withdraw from the study by replying to the initial email with their withdrawal request by June 30th, 2024 (Appendix B). The survey results were analyzed alongside the document analysis to examine perceptions of equity among local governments and how these perceptions are translated into action. Follow-up emails were sent on two separate occasions. The first follow-up was sent on January 30th, 2023, and the second follow-up was sent on April 17th, 2024 (Appendix A).

Although multiple attempts were made to invite individuals in the industry to fill out the survey, only 22 responses were collected out of over two thousand invites to participate in the survey. The total responses represented less than 1% of the potential respondents, well below typical minimum acceptable response rates (5-10%). As a result, data collected through the survey was excluded from data analysis.

3.2 Document analysis

The document analysis shed light on how industry associations like the Urban Land Institute and large developers around the country publicly talk about climate risks and adaptation needs or opportunities. This document analysis encompassed three stages. Firstly, systematic searches using Boolean keyword strings on three grey literature platforms (Appendix C) enabled me to triangulate document retrieval results (Armstrong, 2021). The documents were collected from the following sources: Canada Commons, a digital platform containing a definitive collection of Canadian governmental and non-governmental documents, Google Advanced Search, and organizations listed in the Associations Canada guide (keywords: home, real estate, residential, planning). Secondly, a coding protocol was applied to each document to extract

information about specific items (Table 2). Deductive qualitative coding was selected given the nature of this research, where very few empirical examples of adaptation in the residential building sector has been identified before this study. Deductive reasoning is aimed at testing an existing theory. In this case, adaptation can take on many forms and serve different purposes. Inspired by the research questions that guided this study, the coding protocol was structured to first highlight more general factors, such as the profile type and area of operation, and then move to more specific indicators, including motivations, barriers, industry and firm engagement. A total of 12 indicators were selected, which include: *Author; Region; Type of Organization; Size of the development firm; Sub-market for residential development; Climatic hazard addressed; Adaptation measures; Areas of operations expected; Level of action; Barriers, Motivations, and Industry Role* to ensure a more transparent and replicable research process. Once the document analysis was completed, a thematic analysis was conducted using descriptive statistics with qualitative descriptions to identify recurring themes within the documents and patterns and trends that emerge from the data.

Table 2: Coding protocol for document analysis

Indicator	**Definition**	**Field Operator**
1. Author	Author(s)/ contributors	Open
2. Region	Target region highlighted in the reports	Alberta British Columbia Manitoba New Brunswick Newfoundland & Labrador Northwest Territories Nova Scotia Nunavut Ontario Prince Edward Island Saskatchewan Québec

		Yukon
3. Type of organization	The scale at which it operates	Private corporation Non-profit/ co-op Municipal government Provincial/territorial government Federal government Other *If *Private Corporation* was selected, then Questions 4-5 are applicable.
4. Size of the development firm	The volume of unit production or portfolio managed	Small (Firm employs between 5-99 employees and have less than $100 million in assets under management (AUM)) Medium (Firm employs between 100-299 employees and have between $101-500 million AUM) Large (Firm employs over 300 employees and have over $500 million in AUM)
5. Sub-market of residential development	Residential development that is addressed Many can be selected	Single/ Detached Row house Duplex Apartment, <5 stories Apartment, >5 stories Mixed-use development Other None N/A
6. Climatic hazard addressed	Type of climatic hazard addressed (Lesnikowski, 2021.)	Sea level rise (including storm surges and coastal flooding) Extreme precipitation and inland flooding Storms Drought Wildfires Erosion and landslides Extreme heat events Extreme cold events Water security Other None N/A
7. Adaptation measures	Types of actions/measures suggested by the document/report	Open field Internal (business practices, employee training, certifications)

	For certifications: Green building rating system/ Framework to integrate efficient and cost-saving green buildings	External (Tools, material, the development itself, retrofitting, climate-proofing) None N/A Examples: - Qualified Adaptiv Home Specialist - Qualified Net Zero Builder - Qualified Net Zero Energy Advisor - Qualified Net Zero Renovator -Qualified Net Zero Trainer - Qualified Net Zero Service Organization - Renomark -LEED certification -Energy Star
8. Areas of operations expected to be impacted by climate change	Target areas of operations addressed in the document/report	Development site location Type of build Choice of contractors/ Development / Investment Partners Approval processes Overall productivity and efficiency Profitability Design standards Other None N/A
9. Level action	Level action that is suggested/ currently taking place	Preliminary discussions Decision-making and strategic planning (groundwork) Implementation of policies, actions, or strategies None N/A
10. Barriers	Obstacles (internal or external) faced when integrating adaptation actions	Lack of financing for adaptation/resilience measures Unacceptable cost/ strain on capital Lack of leadership Lack of relevant/ usable information to inform decision-making Low support from industry professionals Other None N/A
11. Motivation	Reason for undertaking adaptation or resilience-building work	Regulatory requirements Insurer requirements Market demand

		Corporate financial risks Experience(s) with extreme weather events Other None N/A
12. Industry role	What role should the private residential development sector play in adaptation and resilience-building?	Open field

3.3 Key informant interviews

Finally, I conducted remote interviews with survey respondents and other representatives from the development industry to gain a more in-depth and humanistic perspective on integrating adaptation into operations. Email invitations were sent to the main contact of development companies that are members of the Urban Land Institute or Canadian Home Builders Association and who have previously completed the survey we administered about adaptation in the development industry (Appendix E). The interview took 45 to 60 minutes, and a total of 16 open-ended questions were posed to interviewees (Appendix F). Once interviews were completed, they were manually transcribed and then analyzed in Atlas.ti with the help of a coding protocol created from the interview questions. Using a deductive coding approach, I developed a set of coding questions based on the interview guide: *Firm's profile; Sub-market; Area(s) of operation; Climate change impacts posing risks on current or future activities; Climate change impacts most concerned about; Climatic hazard addressed; Aspects expected to be impacted by current/future climate risks; Integration of climate change adaptation into its activities; External adaptation measures; Internal adaptation measures; Motivation to undertake climate adaptation into operations; Industry awareness of climate change (adaptation); Barriers/constraints faced by the firm; Barriers/constraints faced by the industry; Leading voices in the industry about*

resilience building; Cost of resilience building should be shared among the private and public actors; and *Role the government should be playing in supporting resilience building in the housing sector* to ensure a more transparent and replicable research process (Table 3).

Table 3: Coding protocol for follow-up interviews

Indicator	**Definition**	**Field Operator**
1. Firm's profile	The volume of unit production or portfolio managed	Small (Firm employs between 5-99 employees and have less than $100 million in assets under management (AUM)) Medium (Firm employs between 100-499 employees and have between $101-500 million AUM) Large (Firm employs over 300 employees and have over $500 million in AUM) N/A
2. Sub-market of residential development	Residential development that is addressed Many can be selected	Single/ Detached Row house Duplex Apartment, <5 stories Apartment, >5 stories Mixed-use development Other None N/A
3. Area(s) of operation	Where does your firm operate?	Alberta British Columbia Manitoba New Brunswick Newfoundland & Labrador Northwest Territories Nova Scotia Nunavut Ontario Prince Edward Island Saskatchewan Québec Yukon N/A
4. Climate change impacts posing risks to	Do you think climate change poses risks to your	Yes No N/A

current/future activities	firm's current or future activities?	
5. Climate change impacts most concerned about	Type of climatic hazard addressed (Lesnikowski, 2021.)	Sea level rise (including storm surges and coastal flooding) Extreme precipitation and inland flooding Storms Drought Wildfires Erosion and landslides Extreme heat events Extreme cold events Water security Other None N/A
6. Areas of operations expected to be impacted by current/future risks	Target areas of operations addressed in the document/report	Development site location (future projects) Choice of materials (type, origin, etc.) Employee training Type of projects Building design/siting General business behaviour (e.g., profitability, financing, regulatory frameworks) Other None N/A
8. External adaptation measures	Types of actions/measures suggested by the interviewee For certifications: Green building rating system/ Framework to integrate efficient and cost-saving green buildings	Open field (Tools, materials, the development itself, retrofitting, climate-proofing) None N/A Examples: - Qualified Adaptiv Home Specialist - Qualified Net Zero Builder - Qualified Net Zero Energy Advisor - Qualified Net Zero Renovator -Qualified Net Zero Trainer - Qualified Net Zero Service Organization - Renomark -LEED certification -Energy Star
9. Internal adaptation measures	Types of actions/measures suggested by the interviewee	Open field (Business practices, employee training, certifications) None N/A Examples:

	For certifications: Licenses, continuing education, memberships from industry associations, etc.	- Qualified Adaptiv Home Specialist - Qualified Net Zero Builder - Qualified Net Zero Energy Advisor - Qualified Net Zero Renovator -Qualified Net Zero Trainer - Qualified Net Zero Service Organization - Renomark -LEED certification -Energy Star
10. Motivation	Reason for undertaking adaptation or resilience-building work	Regulatory requirements Client request Innovation Leadership Market demand Personal value Other None N/A
11. Industry awareness of climate change (adaptation)	Do people in your industry have a general awareness of how governments are planning to address the issue of adaptation in the housing sector?	Yes No N/A
12. Barriers faced by the firm	What barriers do you think your firm faces to building resilience to climate change?	Incomplete/misaligned/confusing building codes, policies, or regulations Lack of financing for adaptation measures Lack of leadership/guidance Lack of relevant/usable data to inform decision-making Low support from industry professionals Overall impression (skeptical, resistant, close-minded) Slow approval rates Unacceptable cost of capital Other Undecided None N/A
13. Barriers faced by the industry	What barriers do you think the industry faces in building resilience to climate change?	Incomplete/misaligned/confusing building codes, regulations, or policies Lack of financing for adaptation measures Lack of leadership/guidance Lack of relevant/usable data to inform decision-making Low support from industry professionals

		Overall impression (skeptical, close-minded, uninterested) Public awareness/knowledge of climate change adaptation (lack thereof) Slow approval rates Unacceptable cost of capital Shortage of labour and/or skilled workers Other Undecided None N/A
14. Leading voices on resilience building in the industry	Who do you think are the leading industry voices on climate resilience issues?	Crown corporations Government parties Industry associations (e.g., Urban Land Institute, Canadian Home Builders Association, Passive House) Large development firms (e.g., DREAM, Daniels Corporation) Research centers/think tanks (Canadian climate institute) N/A None Other
15. The way the cost of resilience should be shared among private and public actors	How do you think the costs of resilience-building should be shared among public and private actors?	Even (private and public should be investing almost equal amounts) Mostly public Mostly private N/A
16. The role the government should be playing in supporting resilience building in the housing industry	What role should government play in supporting resilience-building in the housing sector and real estate industry?	Establish clear and relevant policies Greater leadership Offer greater financial incentives, subsidies, and grants Prioritize climate change Other N/A

Chapter 4: Manuscript

4.1 Introduction

Climate change poses major risks to the housing sector, such as heightening costs tied to insurance, repairs, and construction; loss and damages; and real estate markets (Morrison, 2023). Today, over 16 million buildings are used for residential purposes in Canada, and concerns over their preparation and protection from climate risks like floods and wildfires have been on the rise for Canadian policy-makers (Natural Resources Canada, 2022). According to the Insurance Bureau of Canada, close to 10% of Canadian homes are located in flood-prone areas and do not have access to an insurance program (IBC, 2024a). Wildfires also pose significant risks for housing as 12% of the population lives in the wildland-urban interface (WUI) (Ness et al., 2025), which are areas in proximity to forests which making them more vulnerable to forest fires (Erni et al., 2021). Additionally, projected development patterns indicate that placing 5.8 million new homes by 2030 under current land-use planning frameworks could significantly increase exposure to wildfire risk. According to the Canadian Climate Institute, this trend is expected to drive wildfire-related damages up by 155%, translating to more than $1.1 billion in additional average annual losses (Ness et al., 2025).

While existing research has examined physical and financial risks posed by climate change to the housing sector (Keenan, 2015; Teicher, 2018; Wieteska-Rosiak, 2020), there is limited research examining how housing developers themselves are engaging with this issue, or their readiness to incorporate adaptation measures into both external and internal practices, such as their portfolios, business operations, and development projects. This research examines the following question: Are private residential developers in Canada adapting to current and future climate change risks? Here, we explore the types of actions that developers report undertaking in

corporate reporting and conduct interviews to understand the context in which these actions are emerging. We are interested in how private residential developers perceive climate change risks to their business and the sector, the barriers or constraints to adaptation they experience, and what is motivating them to undertake adaptation work.

4.1.1 The role of Canadian housing developers in climate change adaptation

The central role of the private sector in Canada's housing system positions development firms as important actors in advancing climate adaptation efforts. Canada's housing system has evolved to privilege private developers through a combination of historical policy choices that prioritize homeownership, government retrenchment, and market-driven approaches (Hulchanski, 2006); Langille et al., 2023). Early reliance on the private sector for housing provision was institutionalized during the 1930s economic depression, as federal policies promoted homeownership over public housing through the Dominion Housing Act (DHA) (Hulchanski, 1986). This policy aimed to increase home purchases through residential mortgage lending. In the 1970s, policy shifts led to deep cuts in non-profit and co-operative housing programs geared to low-income households (August, 2022). Private sector developers came to dominate residential construction in an environment where high interest rates and limited construction of new private rental housing contributed to driving up costs of owner-occupied housing (Oberlander & Fallick, 1992). Rather than directly building housing, governments have increasingly relied on the provision of incentives and partnerships with private developers, further entrenching their dominance in Canada's housing landscape. Today private developers supply approximately 95% of housing in Canada (Iorwerth, 2024) and the real estate industry as a whole contributes over 300 billion dollars to Canadian GDP annually (Statistics Canada, 2025). The emergence of Real Estate Investment Trusts (REITs) as a new asset class further

concentrated control over urban rental markets, driving up costs (August, 2020; Langille et al., 2023). This shift solidified the role of private developers and fueled the rise of financialized landlords, who capitalize on economies of scale and low-cost financing to execute large-scale property acquisitions (August, 2020).

Adaptation refers to deliberate efforts to reduce risks and vulnerabilities and/or build resilience to the impacts of anthropogenic climate change (Dupuis & Biesbroek, 2013). Figure 2 illustrates the relationship between adaptation, vulnerability and risk reduction, and the contextual environments that shape adaptive capacity and readiness. Adaptation actions can be categorized as external or internal adaptation actions. External measures can be described as solutions that may materially reduce risks, for example, adding a rain garden near the house to absorb water during extreme precipitation and mitigate heat effects during heat waves or implementing a heat pump to provide year-round heating and cooling by moving heat rather than generating it. Internal measures can be reflected in methods to improve adaptive capacity, for example, an industry actor completing additional licenses or certifications related to sustainable design and/or climate-related risk management. These types of actions help us understand the different forms adaptation can take within a specific context. Some scholarly work is beginning to examine how residential developers are integrating adaptation into their practices and operations. Examples of such practices include the use of fire-resistant materials and roof coverings, installation of sump pumps to reduce basement flooding, and climate-resilient landscaping, which are implemented to reduce fire and flood risk (Evans & Feltmate, 2019; Intact Centre on Climate Change, 2022). The installation of heat pumps and the use of inorganic-based insulation (e.g., rock wool) have been shown to regulate heat transfer, enhancing energy efficiency, improving indoor thermal comfort (Ali et al., 2024; Gard-Murray et al., 2023).

Furthermore, incorporating specific setbacks and requirements can significantly enhance protection against climate risks such as wildfires and floods. These measures include the integration of firebreaks, which typically represent 30-meter-wide zones made of ignition-resistant materials like sand, mowed grass, or roads to slow the spread of fire (Bonada et al., 2025). New construction should also be situated away from flood fringes and the edges of floodplains (Evans & Feltmate, 2019). Additional precautions involve maintaining a 5-meter distance between vegetation and power lines, enforcing a 10-meter setback from the crest of hills to reduce the risk of fire reaching structures, and installing heating, ventilation, air conditioning (HVAC), fuel, and electrical systems on main floors instead of in basements (Bonada et al., 2025; Evans & Feltmate, 2019).

Figure 2: Conceptual model of adaptation

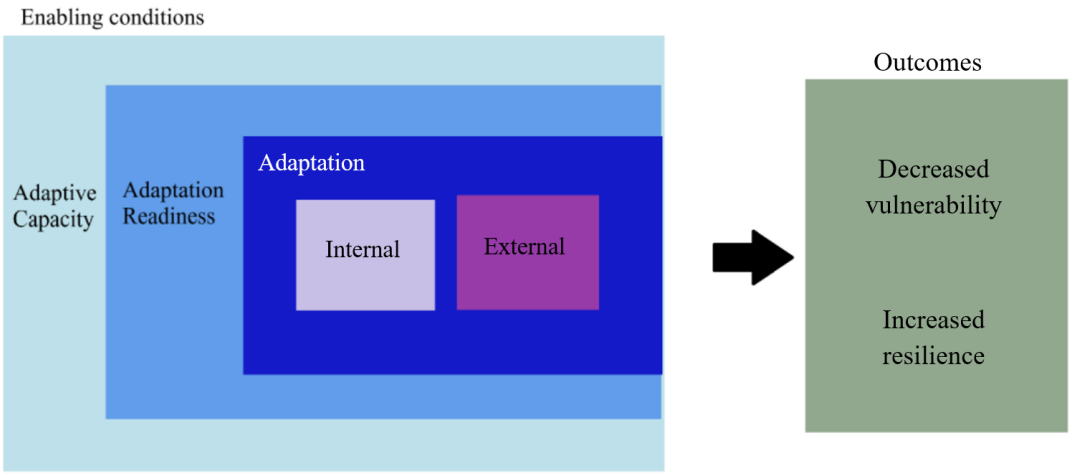


Figure adapted from Lesnikowski et al. (2024)

The ability of organizations or other actors to implement adaptation-related actions is shaped by their adaptive capacity. Brooks & Adger (2004) define adaptive capacity as "the

property of a system to adjust its characteristics or behaviour, to expand its coping range under existing climate variability, or future climate conditions" (p.168). As organizations in the private sector seek to adapt, they need to foster strong collaboration with regulators, suppliers, competitors, and customers. Berkhout et al. (2004) find that companies with strong internal structures (e.g., organizational routines, effective internal communication, flexibility in decision-making) and external relationships (e.g., partnerships) tend to have greater adaptive capacity. When looking at internal structures, Uittenbroek (2016) notes that for most organizations, current routines (the established ways of doing things) are not made to handle climate adaptation effectively, nor to properly include climate adaptation; those routines require a change. In a study evaluating the adaptive capacity of private residential developers in Australia, a comparative analysis was conducted between a small and a large firm. The larger firm was considered to be more resilient and responsive to unexpected climate events like cyclones. Motivated by internal concerns such as brand reputation and long-term legacy, the firm engaged consultants for regulatory compliance and adopted sustainability standards like Green Star (Shearer et al., 2013). In terms of external relationships, contact with customers and negotiations with regulators have helped to increase their awareness (Hertin et al., 2003). In a study evaluating the effects of climate change on the UK building sector, private house-building companies held the view that this informal means of disseminating knowledge and best practice was appropriate, and that more systematic foresight might not be necessary (Hertin et al., 2003).

While adaptive capacity captures the theoretical potential for organizations to realize adaptation, adaptation research demonstrates the importance of supportive enabling conditions that mobilize that capacity into action. Adaptation readiness is defined as "the extent to which human systems (e.g., nations, regions, businesses, communities, etc.) are prepared to adapt,

providing an indication or measure of the likelihood of adaptation taking place" (Ford & King, 2015, p.509). Conditions like political leadership, institutional organization, stakeholder engagement, and support for adaptation are essential for building the preparedness of organizations to undertake adaptation efforts (Ford & King, 2015b). This concept can take many forms, for instance, economic and financial incentives, as well as regulatory frameworks and policies, are commonly used. These mechanisms help offset the high upfront costs of adaptation measures, with government incentives playing a particularly important role in encouraging private sector engagement and prompting companies to integrate adaptation into their operations (Osei et al., 2025). A high level of adaptation readiness creates enabling conditions for adaptation planning, implementation, and evaluation, increasing the likelihood of formal adaptation responses to climate change impacts.

Uptake of adaptation measures in property development or retrofitting are being driven in part by government incentives, such as grants or loans for property-level retrofits like the installation of heat pumps, better insulation, or more modern cladding (Chen et al., 2024; Government of Canada, 2024a). Furthermore, common voluntary green building certification programs like PassiveHouse, BREEAM (Building Research Establishment Environmental Assessment Method), and LEED (Leadership in Energy and Environmental Design) include resilient design options, for example, installing water-efficient fixtures like low-flow toilets and rainwater harvesting systems or integrative passive cooling into building design (U.S. Green Building Council, 2022). Various motivations drive developers to use these certification programs, including corporate leadership, external validation, premium pricing, increased market value, occupant satisfaction, and alignment with prevailing market trends (Rezvani et al., 2023). They also provide a highly visible opportunity for companies to align corporate portfolios with

standardized environmental, social, and governance (ESG) criteria (Hirokawa & Pohrib, 2012; Rezvani et al., 2023).

Mandatory measures, such as building codes, zoning and land-use regulations that set higher standards for new homes or those undergoing renovation, have a broad and direct impact on how developers design and build homes. For example, since 1990, the Province of Ontario has implemented the Conservation Authorities Act, which "prohibits or restricts development and site alterations to protect against flooding, erosion, and other hazards" (Government of Ontario, 2024). In British Columbia, floodplain management is shaped by the Provincial Flood Hazard Area Land Use Management Guidelines, which require any new development in flood-risks areas to meet prescribed standards such as Flood Construction Levels (FCLs) and setbacks (based on a 200-year flood event) (Government of British Columbia, 2024). With targets to ensure that all new buildings achieve net-zero emissions by 2032 and that the existing building stock follows by 2050, the BC Building Code, more specifically the Energy Step Code, provides another example of a regulatory framework that evaluates building performance through the lens of both energy efficiency and climate resilience. Its requirements include the adoption of airtight, well-insulated building envelopes, which improve thermal regulation, reduce heat loss, and ultimately lower overall energy demand (Government of British Columbia, 2025).

Past research has suggested that most real estate developers tend to be slow in addressing sustainability issues and adopting sustainable practices due to a lack of education or financial incentive (Falkenbach et al., 2010). From a rational actor perspective, businesses may see climate adaptation as an economic opportunity to "process of economic and financial optimization" (Keenan, 2015, p.488). Businesses may also view adaptation as a strategic response to external pressures that could trigger market and economic disruptions, while also

accounting for complex social and political dynamics (Danese & De Marchi, 2024; Hertin et al., 2003; Keenan, 2015). Brinke et al. find that "actors are increasingly aware that adaptation can bring value, perhaps not always tangible and direct/short-term but definitely in the long term" (Brinke et al., 2022, p.1161).

From a social constructivist perspective, we can understand the decision to embark on adaptation as the result of organizational learning. Nevis et al. define organizational learning as "the capacity or processes within an organization to maintain or improve performance based on experience" (Nevis et al., 1995, p.73). More specifically, single-loop learning involves the simultaneous modification of an organization's actions according to the extent of awareness/recognition of major variables relevant to their operation/public image (Argyris, 1976). Double-loop learning represents a shift in the values, assumptions, and policies that lead to actions in the first place (Argyris and Schon, 1978). This level of learning is essential for making fundamental changes to core assumptions about the competitive (business) environment (Argyris & Schön, 1978). Although never explicitly introduced by Argyris and Schön, an additional loop was introduced: the triple-loop learning by Tosey et al. (2012). This concept reflects a transformational alteration on the organization's overall structure, particularly its internal motivations and identity, as well as its interactions with the external environment (Argyris & Schön, 1978; Easterby-Smith, 1997; Tosey et al., 2012). In practice, an example of triple-loop learning in the private development sector could involve a firm deciding that its future portfolio will consist entirely of net-zero assets, recognizing that its current projects and building standards do not meet this standard. This shift would stem from a deeper re-evaluation of the organization's long-term purpose and desired position in response to the current climate reality.

4.2 Methods

We employed a multi-method qualitative research design for this study that integrates content analysis of industry reports with interview data from representatives of small, medium, and large development firms. The study received ethics approval from the Concordia University Research Ethics Unit under certificate #30018192.

The document analysis examines how actors operating in the residential development space publicly report on climate risks, adaptation needs, strategies, and opportunities. The document analysis encompassed three stages. First, we conducted a systematic search using Boolean keyword strings in Canada Commons (a digital platform containing a definitive collection of Canadian governmental and non-governmental documents), Google Advanced Search, and the websites of relevant organizations listed in the Associations Canada guide under keywords “home,” “real estate,” “residential,” and “planning” (Appendix C). Based on this search, we collected reports from private developers (n=22), and Real Estate Investment Trusts (n=2). The documents that we were able to identify from private firms include ESG reports or sustainability and impact reports, and were all published by large development firms or REITs. We did not identify any publicly available reports from small and medium-sized development firms that discussed climate risks and adaptation. We proceeded to analyze the content of each document for: *Document Author; Region; Type of Organization; Size of the development firm; Sub-market for residential development; Climatic hazard addressed; Adaptation measures; Areas of operations expected to be impacted; Level of action; Barriers, Motivations, and Industry Role* (see Table 2). We assessed the size of the development firm based on the volume of its business, the number of active projects, and the overall value of those projects relative to the firm's size.

Finally, we compiled descriptive statistics based on these elements that characterize awareness about climate risks facing the development industry and current adaptation efforts.

A multi-methods approach to data collection was useful as it allowed us to capture a more complete and robust data of different sized groups and to triangulate findings. We conducted 14 semi-structured interviews with 11 representatives of small and medium residential development firms, a representative of a crown corporation, and 2 chief executive officers of industry associations (both of which are based in Ontario, operating at a national scale). Interviewees were selected based on two strategies. First, we sent email invitations to the main contact of development companies that are members of the Urban Land Institute or Canadian Home Builders Association and who had previously completed a survey we administered about adaptation in the development industry (n = 4). Additional invitations were sent using snowball sampling to individuals recommended by those interviewees (n = 3). We also recruited participants using a Google keyword search for firms that specialize in green building practices within Canada, including “Green building”, “Green Design”, and “Sustainable Real Estate in Canada” (n=7). In contrast to the document analysis, the participants who agreed to interviews were all from either small or medium-sized firms. Participants from large firms did not respond to the interview invitation or responded that climate change adaptation falls outside their current priorities and goals (n=2).

These interviews revolved around a set of themes, including resiliency, climate risks, and organizational learning about adaptation. Specific questions were personalized to each interviewee based on their industry role, the company they represented, their role within that company, and any relevant information previously known from other sources (such as news media, industry publications, or other publicly available documents) (see Appendix F for

interview questionnaires). Interviews lasted between 45 and 60 minutes. With participants' consent, interviews were recorded and transcribed verbatim. Transcripts were anonymized to minimize participants' risk of identification. Interview results were analyzed by importing the transcribed files into Atlas.ti, a qualitative coding tool. Similarly to the document analysis, a coding protocol made up of 16 elements was created to highlight key statements in the transcripts: *Firm's profile, Sub-market, Area(s) of operation, The role of climate change on current and future activities, Aspects expected to be impacted by current/future risks, Integration of climate change adaptation measures into its activities, External adaptation measures, Internal adaptation measures, Motivation to implement measures, Industry awareness of climate change, Barriers/constraints faced by the firm, Barriers/constraints faced by the industry, Leading voices in the industry on resilience building, Cost of resilience should be shared among the private and public actors, The role the government should play in supporting resilience building in the housing sector* (Table 3).

4.3 Results

The results will be presented in three distinct sections. The first will highlight the current state of adaptation in the Canadian residential development sector and the practical measures being implemented. The second will examine the motivations firms identify for undertaking adaptation efforts, and the third will examine prevailing perceptions of risks and the barriers industry actors may be facing.

4.3.1 Overview of the study sample

The residential construction industry in Canada can be characterized as "highly fragmented," comprising a large number of large, medium, and very small firms, some of which build only one house per year (Hughes, 2024). Because of this low market consolidation,

companies tend to be small and operate independently. Nearly 69% of construction companies operate with fewer than five employees, and only one construction company has a workforce exceeding 500 employees (Laberge, 2024). The results described here capture observed adaptation emerging from large, medium, and small residential development firms. The document analysis examines reported adaptation from 24 large-sized development firms and real estate investment trusts, based on documents like ESG reports and annual sustainability reports. These large firms generally operate in multiple regions of Canada and specialize in building or owning (in the case of REITs) large, master-planned communities or high-rise multi-unit residential projects. In contrast, interview respondents were from medium (n=1) and small-sized firms (n=10) or represented industry associations or government officials (n=3). Most of these firms occupy niche areas that focus on specific types of housing or market segments, such as custom single-family homes or row houses, within one region or even municipality. Within the sample of small-sized firms, one interviewee represented a non-profit housing development company, and another developer specialized in pre-fabricated housing. Together, this sample reflects the diverse types of firms that make up the Canadian residential development industry. In the document analysis, most firms don't specify where they are based and operate either at a provincial or national scale. Given the limited data from other provinces, this does represent a regional bias in both methods and will be further discussed in the limits section. Interviewees from development firms represented companies from Alberta (n=1, small-sized), Quebec (n=2, one small, one medium-sized), Ontario (n=6, all small-sized), and British Columbia (n=2, both small). The remaining participants (n=3) shared the role of chief executive officers in industry associations specializing in green building or employee from a crown corporation.

4.3.2 How are residential developers integrating adaptation into business practices?

The level of climate adaptation action appears to be similar across all the firms identified in the analysis. Within the samples of small, medium, and large firms, many report operating at a stage where strategies, policies, and actions are actively being implemented. Within the document analysis, which consisted of reports published by large firms, 8% report preliminary discussions (n=2), 71% indicate decision-making and strategic planning (groundwork) (n=17), and 83% report implementing adaptation actions (n=20). Preliminary discussions refer to initial conversations or considerations about potential initiatives. An example would be a firm noting that it plans to implement adaptation strategies without yet providing a detailed timeline, such as Skyline's statement that it has "begun to track green space coverage across our direct-drive and third-party managed assets" (2022 ESG Report, p. 9). Decision-making and strategic planning (groundwork) represent the early or pre-implementation stages of future projects. This can include activities such as setting timelines with clear objectives. For example, in Oxford's 2022 ESG Report, the three-year commitment outlook includes: "Standardize physical climate risk assessment approach [and] leverage physical climate risk assessments to inform climate adaptation plans" (p.9), which reflects preparatory work rather than immediate action. Actions refer to specific activities an organization undertakes, for example, a firm conducting a climate risk assessment to understand the chronic and acute risks it may face. For example, Brookfield undertakes a Due Diligence Protocol which includes a climate risk assessment. Using third-party data sources with location specific projections, a team of experts identifies strategies, opportunities and mitigants. The assessment will then be integrated in the pre-design phase of the project (Brookfield Asset Management (BAM), 2024, p.25).

Policies are rules or requirements that organizations adopt and enforce. For instance, in Skyline's 2022 ESG Report, a policy states: "Replace every impacted tree by a new development and expand the installation of community gardens across the apartment portfolio." For the documents that were coded "none," this means no action was reported; however, this did not apply to documents categorized as private or REITs. It is worth noting that certain documents reported initiatives that fell under the implementation of action, policies, and strategies, while also mentioning upcoming initiatives that fall under groundwork planning. The two REITs report implementing actions, policies, and strategies.

This pattern is echoed in the interviews: nearly all the sample of interviewees (n=11) reported integrating adaptation measures, either by acquiring knowledge through climate education or by incorporating specific standards into the construction process. For two participants, the question was not relevant as they are chief executive officers of building associations. Another participant who develops affordable housing also responded no, as very few adaptation efforts have been implemented because of high upfront costs.

Both the document analysis and interviews revealed particular concern with flood-related risks and extreme heat. Among large development firms and REITs, most public reports did not identify any specific hazards as being climate risks of concern (67%). Those who did discuss risks highlighted extreme heat or flood risks related to coastal inundation and storm surges (16%). The remaining risks that made up the foci include droughts (4%), erosion and landslides (4%), extreme cold events (8%), and wildfires (8%). Interviewees from small and medium-sized firms also noted concerns with flood risk and extreme heat (n=10 and 11, respectively).

Reported adaptation was categorized as either "external" or "internal" adaptation measures. External adaptation commonly centers around physical interventions in development

projects that can reduce or protect a structure from climate impacts. These interventions encompass choice of materials, choice of tools, design standards, and certifications related to the design of the building (e.g. PassiveHouse, LEED, TRUE, Investor Ready Energy Efficiency, Zero Carbon Building). Internal adaptations strengthen an organization's adaptive capacity, which may include investing in training, implementing flexible management practices, or integrating climate risk assessments into decision-making, and acquiring professional certifications through industry benchmarks like PassiveHouse, LEED, TRUE, Investor Ready Energy Efficiency, Zero Carbon Building. Certifications fall into both external and internal measure categories, as they can relate to the design of the home itself as well as the professional development of industry actors. Given this double benefit, certifications were often double counted. Although certifications typically represent modifications to external operations, they can also influence internal practices by prompting companies to reconsider future projects.

Among the sample of large firms, most indicated that consideration for adaptation is influencing design standards (n=19; 73%)**,** while nearly half indicated that adaptation is affecting development site selection (n=12; 46%) and type of build (n=10, 38%), and choice of contractors/development/investment partners (n=3, 12%). Among small and medium-sized firms, interviewees also highlighted changes to building design and standards (n=11), material choices (n=7), and used of sustainable design certifications (n=7).

In new construction, examples of reported adaptation measures include installation of hurricane ties of roofs, soft scaping and grading around building foundations, water-proofing foundations, thicker walls, water and vapor barriers, structural sheathing, installation of electric sump pumps and heat pumps, strategic window placements (according to where the sun rises and falls), and airtightness:

> “We have two sets of sump pumps. So, a lot of people have a sump pump that is inside the house. We think that it is a really bad place for a sump pump. And because you're only dealing with the water basically once it's gotten to the point where it's putting pressure, you know, on the slab and the foundation, we have the sump pump away from the house so that it's trying to pull the water away from the house. The second is that we also have a second sump pump that is on the exterior entrance to the house, because there's an exterior walk-down, and an exterior daylight entrance to the basement, and so that area needs its special sump pump protection because water would tend to pool on the exterior into that low point.”
>
> *[Developer of housing firm based in Ontario, 2024]*

When selecting materials, developers are increasingly mindful of their sourcing, recognizing that it plays a significant role in a building’s embodied carbon footprint. Some have established clear standards to minimize environmental impact, such as prioritizing materials made in Canada, selecting products from manufacturers located within a short distance (e.g., within an hour's drive), or choosing suppliers that adhere to sustainable production practices. As a pre-fabricated developer points out:

> “[A] lot of my materials come from the region, right here, right now, within an hour, an hour and a half. You know, my interior wood, my materials, my floors, everything comes from very close by. My windows are made here; the factory is 20 minutes away. [...] Our materials are also very mindfully picked. Our exterior finish is canexil, which is a product made from wood residue that does just that. The interior is planked with pine, which we consider to be a renewable product.”

[*Founder and developer of pre-fabricated firm based in Quebec, 2024*]

Changing existing materials or designing with greener, more sustainable alternatives, especially those that make use of local resources, requires considerable time and effort to identify suitable options. Many interviewees reported conducting extensive online research and attending industry roadshows that showcase locally produced and eco-friendly products. Common materials cited by interviewees include sherpa insulation, known for its energy efficiency and thermal performance; straw bales, which offer strong insulation properties and a renewable alternative to conventional materials; and handmade wooden doors, valued for their craftsmanship, durability, and reduced industrial processing.

Public reports in the document analysis provide various examples of external adaptation measures intended to retrofit existing buildings to better withstand climatic hazards. This approach reduces landfill waste, minimizes the need for new raw materials, and preserves the embodied carbon already invested. As a saying goes in the industry, which was highlighted by two interviewees: “the most sustainable building is an already existing building.” Interviewees also highlighted the financial benefits of retrofits and green renovations:

> “It's less expensive too [retrofits]. I don't know by how much, but in loose numbers on this particular project, the contractor said it was probably 30% less expensive to retrofit this house than it would be to build a new house. We saved the foundation, had minimal concrete, and saved all of the framing. We didn't change the footprint much, so we didn't have to do a stormwater management plan.”

[Founder and principal architect based of green firm based in North BC, 2024]

Common retrofits include installing electric sump pumps and heat pumps, upgrading to triple-pane, low-emissivity windows and fibreglass, wood, or steel doors, adding exterior insulation and membranes for improved airtightness, and modernizing mechanical and electrical systems to enhance overall efficiency. For example, firms reported swapping old equipment such as boilers, ventilation systems and lighting to newer systems. According to Skyline's 2024 sustainability report, the company aims to integrate modern, sustainable, and resilient infrastructure designs into new developments managed by SkyDev and third-party partners. Guided by LEED and Zero Carbon certification standards, the company ensures that both new and existing buildings include amenities such as LED lighting, leak-detecting faucets, sub-meters for CO2, Energy Star-certified appliances, smart electric heat control, and AC replacements, all of which foster positive environmental and social impacts (Skyline, 2024). For upcoming projects, DREAM's net-zero roadmap highlights the firm's emphasis on mitigation rather than adaptation, although several measures indirectly contribute to climate resilience, such as replacing the natural gas–fired boiler system with cold-climate air source heat pumps and using their higher efficiency to enhance the overall performance of the building's cooling system, implementing public green spaces for high-rise residential buildings and window retrofits for better heat exchange (DREAM, 2022). Similarly, Choice Properties, another major real estate firm, highlights water efficiency initiatives that incorporate adaptive practices. Their water management program includes capital upgrades informed by water audits, real-time analytics to optimize operations, and portfolio-wide monitoring to detect leaks and reduce consumption. In addition, the firm integrates xeriscaping and the use of drought-tolerant plants that naturally decrease water demand and enhance resilience to changing climatic conditions (ChoiceProperties, 2022).

Interviewees also discussed how they are trying to be more mindful of designing homes based on location. In doing so, some have adopted a new set of standards to integrate specific design standards for specific climate risks:

> "[R]esilience is also a very significant focus and so we have built this house and many other houses to be in particular resilient to flooding [...] The first thing is soft scaping around the house. We have in the front of the house, basically 100% garden area. In the back of the house, we have a whole, the whole backyard is covered with permeable pavers. The second thing is sloping all of the landscaping away from the house and keeping the downspouts, positioning the downspouts, so that they aren't adding to the flooding problem. The third thing is the kind of waterproofing around the foundation. We think that because of flooding, people should be considering no basements. The municipalities would have to increase the maximum height of homes to make up for the fact that there's no basement."
>
> [*Co-founder of sustainable building firm based in Ontario, 2024*]

Interviewees from small and medium-sized firms also described common internal adaptation measures used to strengthen their adaptive capacity. These included professional development opportunities (n=11), such as attending conferences and obtaining certifications from industry associations like Passive House and LEED. Findings related to external adaptation measures similarly emphasized the pursuit of certifications, this time for organizational assets, as a means of guiding design standards. In the document analysis, third-party sustainability certifications have encouraged organizations to reassess their sustainability approaches and to voluntarily disclose emissions and climate-related performance (Brookfield Asset Management,

2023). In the same vein, Environmental, Social, and Governance (ESG) training and frameworks were frequently mentioned. ESG frameworks help organizations educate employees on emerging and relevant practices, while also informing the design standards applied to future projects.

Furthermore, multiple interviewees emphasized the importance of continuing education in light of evolving climate realities and market trends (n=8). For the developers in the sample, staying informed about emerging sustainability-related trends and practices in the construction sector is viewed as part of their professional responsibility. Interviewees highlighted the need to expand their knowledge of climate science and green design by attending workshops offered by organizations such as Sustainable Buildings Canada (SBC) and CommonEarth, industry associations like the Canadian Home Builders' Association (CHBA) and the Building Industry and Land-Use Association (BILD), as well as crown corporations such as BC Housing. These workshops cover topics such as climate science, deep energy retrofits, and updates to building codes.

Research and development practices were also noted as key opportunities for industry professionals to share current information and discuss emerging trends, particularly by drawing on diverse areas of expertise (n=5). Several participants emphasized that, for smaller firms, regular meetings and discussions facilitate this exchange of knowledge and help ensure alignment on project objectives:

> "We talk about these things all the time. We do webinars periodically and each of us is encouraged to get your CAGDC certification and get your Passive House certification and that sort of thing. But this is because it's our specialty, right? So we definitely do

that."*[Founder and principal architect of a green development firm based in Ontario, 2024]*

"We have a sustainable development committee that includes one representative from each department within the company. We meet once a month, so we have a manager from finance, acquisition and development, construction, and HR, nine managers in total. This ensures that if there are any questions or when developing standards, it is not a unilateral process and that we are realistic in terms of our approach and the time spent."

[Sustainability Coordinator in development firm based in Quebec, 2024]

Document analysis also highlighted participation in open forums and collaboration with third-party stakeholders, where stakeholders engage in knowledge exchange with other firms:

"We collaborate regularly with outside stakeholders, including industry groups, and encourage our portfolio companies to participate in knowledge sharing forums. […] We seek opportunities to work with stakeholders where we can help inform the public and influence government actions and decisions in ways that protect and support Brookfield's business interests and reputation. We are members of various industry-leading groups and contribute to industry-led publications."

[Brookfield Asset Management, 2023, p. 61]

"Skyline ESG Taskforce launched with 15 members. Taskforce exemplifies ESG leadership; ensures inclusive policies and procedures; engages sustainability partners through open forums."

[Skyline, 2022, p. 17]

> "Through our multi-department ESG Committee, we work to identify initiatives to reduce GHG emissions and are exploring options such as going electric or using dual fuel for hybrid energy in our building systems. […] We have engaged third-party consultants, including scientists and engineers, to help us. Our goal is to apply all the lessons learned holistically to ensure existing buildings and new construction projects meet local, and our own, standards as we elevate them to create greener, more environmentally friendly developments."
>
> [*Concert Properties, 2022, p.18*]

In addition, life-cycle assessments (LCA), templates, and toolkits are also used to conduct vulnerability assessments and identify climate risks to operations. These practices are described by firms such as Cadillac Fairview, QuadReal Property Group, and Oxford Properties.

For example, Cadillac Fairview (CF) states in its 2023 ESG report:

> "In order to build climate resilience, CF continues to identify climate-related risks and develop adaptive capacity to respond to these physical and transitional risks. For example, using CF's Climate Risk and Resilience Toolkit through GAW [Green At Work], we survey each property team annually to determine the greatest risks for each site and develop corresponding solutions to mitigate impact of acute and chronic weather events such as floods, wildfires, storms, heat stress, etc. At the portfolio level, we continue to evaluate our asset exposure to different transition risks such as regulation trends, increasing insurance claims, market shifts, and more."
>
> *[Cadillac Fairview, 2023, p. 12]*

Similarly, Fiera Real Estate describes the use of MSCI's Climate Value at Risk (CVaR) tool:

> "To monitor and measure FRE's ongoing exposure to physical and transition climate risk, we subscribe to MSCI's Climate Value at Risk ('CVaR') tool, where CVaR represents the combined discounted transition policy risk costs and extreme weather event costs expressed as a percentage of the asset's value. This tool is used across our global real estate business and is used as part of our due diligence process to understand the physical climate risk exposure of any potential new acquisition. An investment will only proceed if the CVaR results meet our minimum thresholds. For our operational assets, the tool is used on a quarterly basis to continually understand the portfolio's exposure to physical climate risk and to identify which assets should be prioritized for mitigation and adaptation strategies."
>
> *[Fiera Real Estate, 2023, p. 15]*

4.3.3 Industry motivations to undertake adaptation

Firms expressed different sources of motivation for engaging in climate adaptation that are shaped by their capacity, market position, and organizational priorities. Among large firms, key motivations identified from the document analysis include business dominance (e.g., leadership, competitive advantage, profitability, n=20), regulatory requirements (n=11), and market demand (n=10). These motivators are echoed in the REIT reports. We observed a recurring narrative in these documents where large firms aim to position themselves as industry leaders in sustainability, climate mitigation, and adaptation, influencing best practices and setting the standard for others to follow. A recent ESG report published by large developer Minto details

the process of retrofitting their existing commercial and residential properties to encourage other firms to partake in similar measures. The report states:

> "At Minto, innovation is one of our core values. We constantly question our actions and look for better ways to do things. Innovation across all areas—from culture to process to product—is needed to maintain competitiveness and drive performance in this industry. […] A formal Innovation Strategy and Framework allows Minto to focus on creating a culture of innovation that is embedded in our products and processes. This focus ensures that Minto continues to find innovative approaches to building a better tomorrow."
>
> [*Minto, 2022, p.19*]

Some interviewees also talked about being motivated by market demand (n=2). Certain development firms integrate sustainable development priorities into their business strategies, aligning them with the values and goals of their investment partners. This approach ensures that sustainability initiatives are not only a corporate responsibility but are also prioritized in financial decision-making. The ESG lead and sustainability coordinator of a Quebec-based firm explains how their company has taken proactive steps to structure sustainability efforts around their partnerships:

> "What we've done in the last year is we've met with all our partners to get them to fill in a questionnaire to find out their ESG priorities, those related to sustainable development, and how long they plan to spend on these objectives. Based on this, we are in the process of developing standards for each component of our project."
>
> [*Sustainability Coordinator in development firm based in Quebec, 2024*]

By surveying their partners, the firm gains insight into the specific environmental, social, and governance (ESG) goals that investors prioritize. This method reflects a growing trend in the real estate sector, where firms are recognizing the importance of aligning their ESG commitments with those of their financial backers. By doing so, they enhance investor confidence while contributing to the broader adoption of responsible development practices.

Driven by market value considerations and investor expectations, leading firms are adopting internal adaptation measures through green financing frameworks that embed climate resilience into investment decisions. Companies such as Oxford Properties, Ivanhoé Cambridge, and Brookfield now include climate change adaptation as an eligibility criterion for project financing. Ivanhoé Cambridge, for example, has deployed over C$14 billion in sustainable financing in the past five years and indexed nearly C$10 billion of corporate financing to its ESG performance. Likewise, in 2022, Oxford Properties issued a green bond to support green buildings and projects focused on pollution prevention, control, and climate change adaptation in Canada and the United States. A discussion with one of the participants revealed a significant divergence in how actors think about the benefits and negative impacts of sustainable design (cost, appeal, corporate image, etc.):

> “The people are starting to demand that the buildings have some solutions built into them. But I'm not sure the development community by itself would deliver those kinds of results. They need to be encouraged or they need to see an economic profit-based reason for doing that, right? In the past, green buildings had higher market value. [...] That was a motivator for developers. I think that still is the case. People do want to be in better houses.”

[*CEO of industry association, 2024*]

Engaging in climate adaptation helps large firms differentiate themselves in the market. By adopting resilient and sustainable practices early, they can attract investors and environmentally conscious clients, strengthening their market position:

> "Our investors have their own ambitious ESG targets, which have resulted in increasingly frequent and detailed questions regarding the strategies' performance. To better ensure that we are supporting them in these ambitions, we have created an ESG dashboard to visualize, monitor and analyze the data collected, along with additional ESG data points such as carbon emissions, physical climate risk and building certifications (e.g Building Research Establishment Environmental Assessment Method/Energy Performance Certificates.)"

[*Fiera Real Estate, 2022, p.11*]

As awareness of climate risks grows, firms recognize the need to align their practices with market trends. In interviews, many reported that clients frequently approach them with specific feature requests and are receptive to added climate-related features:

> "They come to us (clients) already wanting to do it. If they don't, we can show them things like this and say, this is why it's important. And this is what you have to do, electrify, super insulate. [...] We don't have to convince them of anything. We just have to show them how to do it. They already want to do it. We have to show them."

[*Principal architect in Toronto-based firm, 2024*]

Oftentimes, industry actors lean on these green features and certifications to create a "selling point" to homeowners or renters, which is pointed out by a chief executive officer from an industry association:

> "[W]e actually run courses for realtors about how to sell a passive house. You know, a passive house condominium unit. They don't know anything about PassiveHouse. They hear it's some high-efficiency thing. So, we have a real simple introduction to PassiveHouse for realtors. And, of course, they come at it, oh, we can sell this house for a premium, which isn't what I want. The last thing I want is for people to think that passive house is for the wealthy and the elite. The good thing is that most of the passive house uptake in Canada over the past couple of years, past three years, has been with social housing: Toronto Community Housing, Hamilton Housing, Vancouver, BC, in Quebec, they're building PassiveHouse."
>
> [*CEO of industry association, 2024*]

Among medium and small firms, interviewees highlight that another prevailing motivation is personal values, especially among those with founder-led leadership, which prioritize sustainability due to personal beliefs on environmental issues (n=6). The smaller firms in the sample are generally specialized in green construction and typically undertake only two to three projects per year, working closely with clients from the initial consultation stage through to project completion. As a lead architect at a firm based in Toronto states:

> "I feel like there is a deep-seated feeling of responsibility. When you commit someone's time, money, and global resources towards a building, it should be for keeps. You need to

make sure that what you're doing, you get one shot at this. So, what you're doing is the best it can be for the long run."

[*Principal architect and founder in Toronto-based firm, 2024*]

"We're a sustainable home building company, purpose over profit type of company. We're not a traditional custom home builder, we're not a net zero company, and we're not a passive house company, at its core, we're a sustainable home building company. And if there was no problem to solve in the world, such as climate change, [company name] built probably wouldn't exist as a company. There's no problem to solve."

[Founder of sustainable development firm based in Ottawa, 2024]

4.3.4 Barriers and constraints faced by the industry

The housing sector faces multiple barriers and constraints, including inherent tensions both internal and external, between developers and the government. Before diving into those barriers, it is important to highlight a key finding from the document analysis: 92% of the firms represented do not report any significant barriers to implementing climate adaptation measures (n=22). Many reasons can justify this finding; a lack of awareness, reluctance to disclose challenges, or greater access to financial and organizational resources. This is echoed by the sample of REITs reports (n=2). In other words, these reports do not mention encountering difficulties; instead, they are framed around ongoing projects and future objectives. The remaining reports identified limited financing and inadequate information as primary obstacles to adaptation efforts. The barriers raised in this research were derived primarily from the interviews. Participants identified multiple barriers impacting both their own operations, which

reflected internal obstacles and the sector overall, which represents tensions from outside factors or externalities.

4. 3.4.1 Internal barriers

Within the industry, perspectives on climate change remain divided. Some actors remain skeptical of climate change, while others actively research climate-related issues and expect their peers to stay informed and aligned with current knowledge. An email correspondence we received indicated that some actors in the industry hold views that deny the reality of climate change:

> "Kindly, there is no such thing as “Climate Change”! The climate fluctuates, and it always has and always will. Builders can choose to adapt their building methods to best suit their customers’ needs… plain and simple. Please remove me from your email list as I do not believe in this Liberal agenda called “Climate Change”. Move on, please."
>
> [*Emailed response from a developer received in July 2024*]

Entrenched building practices, particularly among certain industry actors, influence decision-making and project execution. Two interviewees both expressed difficulty in trusting contractors, as some make executive decisions to omit critical details from architectural drawings and given their profit-driven mentality, it is difficult to collaborate:

> “Builders are programmed to follow the code as this is the minimum that they have to build to. They're trying to do things as inexpensively as possible. [...] So, putting in the insulation where you don't have to is simply added costs for the client, it's not required. They are not thinking that by doing this [adding insulation], you're going to be saving a lot of money on your heating bills over the next years.”

[*Lead architect based in Ontario and BC, 2024*]

> "[M]ost developer companies are based on profit and they're not home building companies. I think of them more as investment companies. And they want to maximize the return on their investment, the way that's done is by building the lowest common denominator."

[*Founder of a sustainable development firm based in Ontario, 2024*]

Additionally, there is also a fundamental lack of clarity regarding adaptation itself. Without a clear definition, developers rely on their own interpretations, leading to inconsistencies in implementation and ultimately, potential maladaptation. As a lead architect from an Ontario-based firm points out: "Adaptation is really hard and I defy you to define it. I mean, our biggest problem is that [...] we know that we don't know, right?" (Lead architect and founder of an eco-friendly development firm, 2024).

4.3.4.2 External barriers

Multiple interviewees discuss challenges rooted in outdated and misaligned policies and building codes that do not reflect the realities of climate adaptation, making it difficult to implement necessary changes as a firm (n=8). This barrier is also echoed as a barrier for the industry overall as well (n=6). In discussions with interviewees:

> "I'm actually on the Ontario Association Codes Committee. They're not changing fast enough; the federal government is changing the national building codes as well. We know it's coming. We know that we have to move in that direction. If you build something now

that's not thinking about how quickly things are changing, and then you have to go back and fix things in a few years, it's going to cost way more."

[Founder of firm based in Ontario and British Columbia, 2024]

"[W]e mostly work with nonprofits, or municipal housing authorities. So for both of which the market is not irrelevant. But, you know, because CMHC makes you hit certain rent targets, right? So that's market driven but hitting that market is definitely an impediment. And lack of clarity from our politicians and governments is a huge impediment. And I know the planning because I know people who work for Toronto Hydro and for the ISO, which is the independent electrical system operator of Ontario. And I know work is going on inside the black box, but they're just arm wrestling with other departments. And somebody at the top says, Okay, we're doing that, right. And it's never really climate adaptation. So I think the impediments are lack of clarity, lack of understanding."

Further in our discussion, the participant highlighted other factors that make up their reality:

"When you talk to people, it's certainly not a lack of desire to address climate action in a meaningful and effective way. But that definition, the piece that's missing. I can tell people, you know, this is going to help us as Ontarians, because we pay taxes, and we ultimately run the electrical system, which is a public utility. But the public utility is silent. So why would anyone believe me right there? So those are our biggest impediments, lies."

[Lead architect and founder of firm based in Ontario, 2024]

The decentralized approach to climate change adaptation that characterizes Canadian climate adaptation governance was highlighted in the interviews and further undermines adaptation progress; municipal standards vary widely, and developers must navigate differing requirements across jurisdictions. As an interviewee points out:

> "[I]t's not fair […] if you're building south of Steeles Avenue in Toronto, you have one green standard. Then you cross that street, you build an equivalent building in Markham or Vaughan, and it's a different building standard. It's confusing and that costs money. If you have to take your building [plans] and go back and run it through the architects and the engineers, that's an upfront cost and it's a time delay."
>
> [*Chief executive officer of industry association, 2024*]

The integration of adaptation measures is costly, and interviewees identified regulatory complexity and instability in government adaptation financing as significant challenges: "Everything that I do on a project changes my base design, not only the money for the different features, but it's the time that goes into having to do something different, even though it might be the right thing. So, I will never do another solar panel project because I did one once and it was a disaster." Through an email exchange, the interviewee outlined the factors that shaped his negative experience:

- A cost premium of approximately $1 million for design and installation was added to a $30 million asset. Given the firm's focus on affordable housing projects in Calgary, this additional cost would substantially influence unit affordability for buyers and renters.

- The initial promised government support was "no longer available" after provincial elections.
- The electrical generation performance was not sufficient to offset costs of installation.
- The regulation around the design with the supplier was both lengthy and overly complicated.

Others expressed discontent in terms of approval processes, as a lead architect based in BC and Ontario highlights on a current project that she is working on:

> "We are working with the community, the building is historic, so we are doing the historic preservation of it. We are doing all the right things and yet, the government approvals, so the municipal approvals are being stretched out and are taking so long. They require every little step as though you are doing a new development. It's not one person or a group causing the problem; each person in their job feels like they have to check all of their boxes and the process is just dragging when we are in a crisis for affordable housing. It's frustrating that things are slower to be approved."
>
> [*Founder of firm based in Ontario and British Columbia, 2024*]

Finally, some interviewees pointed out that the paperwork for financial incentives was too lengthy:

> "But at one point, the Toronto Hydro, or ISO, […] they were making us fill out [an] eight-page form on a rooftop unit. It's a little, it's a box, but you know, it's, and that is so that you can make sure that nobody games the system, right? Well, it costs me all of that time, like more than the $500 that they're going to give my client for filling out the eight pages, right? The systems that they're using are broken, ill informed, frustrating. So mostly I ignore them."
>
> [*Founder and lead architect of a green development firm based in Ontario, 2024*]

Overall, these constraints feed into the tension with the different tiers of government. Many developers are calling for stronger government leadership, including updates to the building codes and financial incentives to support the integration of climate adaptation measures.

4.4 Discussion

This exploratory study examines the current stage at which the private residential development industry in Canada is adapting to climate change. Findings reveal that the firms in the sample are actively implementing adaptation measures, strategies, and policies, but nonetheless, adaptation is not a priority. There is a noticeable push to integrate adaptation into both internal and external operations, with varying degrees of willingness and capacity across firms. Although these efforts are evident in ESG reports and interviews, this study does not assess the quality or outcome of adaptation actions. Rather, it provides an overview of the current level of engagement with developers across the sector. Our findings identify concrete examples of both internal and external adaptation practices emerging in the development industry and contribute to expanding the empirical literature on adaptation in the housing sector.

Our findings indicate that external adaptation measures primarily involve altering their own building and design standards drawn from research and development, certification requirements, and material selection, while internal measures focus on professional development, workshops and research and development. Many industry actors engage in continuous learning through conferences, professional certifications, and workshops accessed via continuing education programs. Additionally, firms emphasize internal research and development, leveraging employees with diverse expertise to stay updated on emerging trends. A key motivation shared across firms of different sizes is market demand. The sample of large firms are primarily driven by the pursuit of market dominance and competitive advantage, positioning

themselves as industry leaders in innovation while aligning with emerging market trends and consumer expectations. The sample of medium and small firms are driven by consumer demand and investor expectations as central drivers of their actions. Additionally, for smaller firms, personal values can play a significant role. In the case of particular types of boutique firms, there is a stronger willingness to integrate adaptation measures directly into their projects, given their specialization in green construction or green design and their close relationship with clients.

A notable finding in the document analysis was that a significant portion of the sample of large developers do not report any barriers when it comes to integrating adaptation into their operations. This may suggest that larger firms have greater resources, financial flexibility, and institutional capacity to navigate challenges that smaller firms struggle with. In fact, they might also have dedicated sustainability teams, access to government incentives, or the ability to absorb upfront costs associated with adaptation. Additionally, large firms often have more experience complying with evolving regulations, making it easier for them to integrate climate resilience into their operations. Another consideration could be that larger firms are not transparent with their engagement with adaptation, given that this finding is pulled from the document analysis, where private documents were primarily companies' ESG reports. It is important to keep in mind that reports are written in an optimistic tone to portray themselves in the best possible light. We should therefore be somewhat skeptical of them at face value. Beyond the question of transparency, these reports will highlight on what they are doing rather than what they are not doing or unable to do, which represents a methodological limit to try to identify barriers with these types of documents. Lastly, firms may struggle to identify certain barriers because they often focus on adapting to a single climatic risk, such as flooding, without accounting for the possibility of simultaneous or compounding climate events.

An interviewee highlighted a major difficulty when it comes to integrating adaptation-related measures: there is no formal and agreed-upon definition of adaptation. As a lead architect and founder of an eco-friendly development firm, in our discussion points out: “Adaptation is really hard and I defy you to define it. I mean, our biggest problem is that we don't know, right?” (Lead architect and founder of an eco-friendly development firm, 2024). Consequently, this developer has taken on their own interpretation of adaptive/resilient building. Uncertainty can lead to a conflation of concepts, where efforts are directed toward mitigation rather than adaptation. Furthermore, with no formal definition of adaptation, conceptualizing different strategies and preparations to address climate change may lead to misinformed decision-making in the face of a climate event or in a period of preparation to face one. Concerns for potential for maladaptive outcomes have been raised by Keenan et al. (2016). The authors interviewed urban planners, architects, designers and real estate professionals to evaluate their understanding of the respective concepts and normative meaning of adaptation, resilience, coping and mitigation. Results of the study highlight conceptual confusion due to the lack of consistent definitions for terms like resilience and adaptation among professionals. Only 25% of the participants were able to properly associate the concept and meaning. This is because resilience, despite being a popular buzzword in policy discussions, is poorly understood and inconsistently applied (Keenan et al., 2016). The research calls for greater clarity when it comes to definitions, which will help to avoid any inconsistencies and limit any potential challenges for policy development. This highlights an ongoing capacity challenge for actors in the development industry and highlights the need for more discussion around the definition of adaptation and what gets "counted" as adaptation.

4.4.1 Industry Inertia

A recurring observation among non-developer interviewees was that developers often refrain from integrating adaptation measures into their projects, perceiving them as financially risky and unwilling to act as guinea pigs. A chief executive officer of an industry association (2024) points out: “It's inertia in the building industry, in the design and building with developers. […] They've done it this way for 20, 30, 40 years, you know, in their company” (CEO of industry association, 2024).

This is similar to findings from Keenan (2016), who looked at how commercial real estate firms in New York are preparing for climate risks. Results emphasize that firms prioritize financial stability over proactive adaptation and tend to focus on short-term risk management. Institutional inertia influences whether organizations adopt or ignore a practice, how they shape its form and content if adopted, and whether they maintain or eventually abandon it (Aksom, 2021). Organizations often prefer to approach change in an incremental way, where the status quo is maintained as much as possible along with its existing organizational structure, strategies, and practices (Berkhout et al., 2004; Repetto, 2008). In many cases, changes only occur reactively when existing routines are proven ineffective (Berkhout et al., 2004). As a result, changes occur rarely and willingly and are often triggered by a major threat or climate risk. As a sustainability coordinator from a Quebec-based firm (2024) points out: “[N]o, it's the kind of situation where if it happens [climate risk events] once on our buildings, we do an audit on all our buildings and then make modifications as needed.”

The Canadian development industry is known for being conservative with respect to change. Industry professionals have relied on the same practices for decades, often justifying them with the mindset: “That’s the way we’ve always done it.” In an interview with a chief

executive of an industry association, he points out: “I mean, the building industry is still building the way it did 100 years ago, you know? I mean, in all honesty” (CEO of industry association, 2024). As a result, without regulatory pressure, there is little motivation to adopt new approaches. The responsibility to integrate climate change adaptation policies and strategies has been delegated to lower-tier governments, specifically, municipalities (Ness & Miller, 2022a). Municipalities often have the fewest financial and organizational resources, making it even more challenging to implement effective adaptation strategies that align with other municipalities and different levels of government. This disparity has led to an uneven playing field, as access to resources for adaptation varies significantly across provinces, regions, sectors, and communities (Ness & Miller, 2022a). Oulahen et al. (2018) argue that “adaptation is more than just local.” Limited collaboration across governments and with the private sector is essential for managing in this context, coastal flooding, but staff constraints, silos, and difficulty integrating adaptation into routine work continue to hinder progress (Oulahen et al., 2018). The absence of senior-level political leadership (specifically provincial and federal) creates for complex vertical linkages across jurisdictions. Ness & Miller (2022b) highlight: “Historically, Canada’s approach to climate adaptation has been characterized by decentralized and uncoordinated efforts of different orders of government, the private sector, and civil society groups” (p.5). The federal and provincial governments have greater legal authority, wherein the federal government offers subsidies and funding, which influences local development choices. Although the National Adaptation Strategy marks significant progress toward more effective national adaptation efforts, current federal government investments remain well below what is needed (Ness & Miller, 2022a). The provincial government has primary control over land use by establishing policies and regulations. This leaves municipalities in a position where they are required to implement

and enforce land-use planning. As a consequence, local municipalities "overshadow their ability to effectively prepare for the future" (Birchall & Kehler, 2023, p.2). Poor guidance, unclear policies, and a lack of clear coordination will lead to a weak approach to adaptation, while relying on municipalities would create a patchwork of duplicative regulations rather than a predictable and coherent policy framework.

Organizational learning is a key factor enabling the implementation of adaptation measures. In this research, the most common internal adaptation measures include professional development (attending conferences, acquiring certifications), workshops (continuing education) and research and development. For many, adaptation is a low priority for an organization wherein they delay action until directly impacted by climate risks. Argyris and Schön (1978) introduced the concepts of single- and double-loop learning as a framework to evaluate how practitioners and organizations learn by detecting and correcting errors. Single-loop learning represents an error-correction approach where a strategy will be implemented to address a situation while preserving the current norms, routines, and policies remain the same (Smith, 2013). Double-loop learning represents a modification in the norms, routines and overall objectives to address the situation (Smith, 2013). According Argyris, double-loop learning allows actors to instill adequate changes in quick-changing and uncertain environments (Smith, 2013). Zero-loop learning refers to the absence of intention to change, where organizations continue with business-as-usual practices despite emerging challenges or new information which is the approach practitioners and organizations adopt before single- and double-loop learning.

Applying this framework to our findings, the two common approaches to adaptation were reactive (ex-post) and proactive (ex-ante). On the one hand, approaching adaptation in a reactive way highlights the transition from zero-loop to single-loop learning. In a state before being

impacted by a climate risk, firms are in a state of zero-loop learning, where they may acknowledge the presence of climate risks but have no intention to change their business operations. Single-loop learning will be adopted in response to being impacted by climate change. For example, one of the interviewees claimed that external adaptation measures will not be implemented until one of their assets is directly impacted, and employee training will eventually become a requirement, but the priority is low at the moment.

Senge (2005) would call this "reactive mindset" as an organization is "waiting until a situation gets out of hand before taking a step" (p.19). As for those who claim to adopt a proactive approach, they have aligned it with their professional development by acquiring certifications and attending conferences. Firms that are actively integrating adaptation measures into their internal and external operations can simultaneously enhance their organizational resilience, improve the quality of their decision-making, and position themselves as leaders in a rapidly evolving regulatory and market landscape. In this sense, certifications sit between second-loop and third-loop learning, adjusting design standards to solve specific problems (double-loop learning), while also encouraging firms to reevaluate their value systems and overall approach to construction (triple-loop learning). Additionally, attending workshops through continuing education has allowed them to acquire greater knowledge and understanding of climate science to rethink their business approach by updating factors like their building and design standards. For example, one of the interviewees claims to take a "renovate first" approach as preserving the existing building envelope can minimize major costs, reduce carbon production and waste and avoid the use of new raw materials.

4.4.2 Limitations and future research

This research brings much-needed attention to how Canadian housing developers approach climate adaptation-related practices. The findings from this study are exploratory rather than representative, which can be attributed to a few notable limitations. In addition, participants were concentrated in three provinces: Quebec, Ontario, and British Columbia, so the findings do not provide a full national picture of climate adaptation in the industry. The sample of small and medium-sized firms came primarily from semi-structured interviews, which encouraged participants to elaborate their answers, while large firms were represented through document analysis. Because public reports (e.g., Impact, ESG, or annual sustainability reports) tend to highlight achievements and future goals, they rarely discuss barriers, as doing so may be perceived as a weakness and could affect public image, which represents a methodological limit. Given that the document analysis and semi-structured interviews serve different purposes with different formats, this represents an additional methodological limitation, as a specific sample of groups participated in each, rather than both.

In future research, a study looking at empirical cases could evaluate the outcomes of adaptation measures to see if there is fundamental change, partly because research on outcomes is underexplored, as it tends to identify the current practices rather than their long-term effects. Given the evidence that private residential developers are adapting in Canada, it is important to evaluate how their adaptation choices hold up over time and whether they have actually fulfilled their intended purpose. It would be valuable to examine the effects of updated building codes and adaptation-related policies (e.g Canadian Building Code published late 2025) on industry acceptance and outcomes. Maladaptive outcomes like green gentrification (Anguelovski et al., 2022, 2024; Garcia-Lamarca et al., 2021; García-Lamarca et al., 2022) have been studied in the

context of private urban development in Europe and the United States, however, there is limited research on green gentrification in a Canadian context. Building on the barriers and limits highlighted from this study, exploring both the potential barriers and moral imperatives of adaptation in large firms, as industry reports tend to overlook these factors, would help us to better understand decisional tendencies linked to organizational learning and realities. As it stands, reporting frameworks (e.g., Global Reporting Initiative, Task Climate Force Disclosure, Carbon Disclosure Project) are voluntary and lean heavily toward the financial dimensions of sustainability. Comparing the use of different frameworks would offer important insight into their priorities, internal capacities, and decision-making processes. Additionally, a comprehensive study of how the industry defines adaptation would be fruitful given the current lack of clarity. This research would help us better assess its level of understanding and the decision-making processes behind adaptation integration.

Chapter 5: Conclusion

This research is the first to examine adaptation in Canada's private residential development industry. As climate-related events in Canada have increased in frequency and intensity, concerns are growing over how future housing will be built and how the existing housing stock can be adapted to withstand both current and future climate risks. The intersection between the climate crisis and the housing crisis has become a key consideration as it is crucial to ensure homes are located in low-risk areas for the safety and security for communities. Addressing these challenges requires not only technical solutions but also a deeper understanding of who holds the responsibility for implementing adaptation measures.

Canada's housing system has evolved in a way that places private residential developers at the centre of shaping building practices, as they supply most of the country's housing. Their decisions determine where and how homes are built, directly influencing the sector's climate resilience and raising important questions about their readiness to address emerging risks. Findings show a comparable level of adaptation activity across firms of different sizes, with both document analysis and interviews indicating that many are beginning to incorporate adaptation strategies into their operations. Flooding and extreme heat stand out as the risks of greatest concern. Among larger firms, adaptation is primarily driven by market demand and investor expectations, whereas smaller firms tend to be motivated by market demand and personal values. Developers also face a mix of internal and external barriers: internally, entrenched practices, skepticism, and uncertainty about what adaptation entails; externally, outdated or misaligned policies and building codes, compounded by a decentralized and fragmented governance landscape.

Although developers across small, medium, and large firms acknowledge climate change, only some are actively integrating adaptation measures, while others view adaptation as uncertain or a low priority. This hesitation stems from limited regulatory pressure, weak leadership from governing bodies, unclear or inconsistent policies, and gaps in climate-science understanding. As a result, the development industry lacks clear guidance on how to incorporate adaptation into its operations and must navigate uneven requirements across municipalities, making the pre-construction process increasingly complex and time-consuming.

In terms of limitations of this research, the low response rate to the online survey meant the results were not considered and reliance on interviews and document analysis was required. The majority of interviews were conducted with developers from medium and small firms that belong to a niche/specialty market based in larger provinces, namely Quebec, Ontario and British Columbia, and so do not capture other regional contexts. This could be explained by the fact that these provinces represent Canada's three largest provincial economies and contain the majority of urban growth and real estate activity, hence a higher concentration of developers. Additionally, major metropolitan areas like Montréal, Toronto, and Vancouver are primary hubs for residential development. These provinces tend to be leaders in climate and environmental policy, which means firms based there are more likely to be aware of or engaged in adaptation discussions. BC has strong building energy codes and a provincial climate adaptation strategy. Quebec has provincial climate policies and active municipal adaptation planning. Ontario's Green Building Standards and municipal climate policies (e.g., Toronto Green Standard) help to mainstream adaptation. While larger developers were contacted to partake in interviews, none had agreed to do so despite multiple invites.

In contrast, the sample of firms captured by the document analysis was limited to large firms and REITs. This is because ESG reports typically come from large firms based in larger provinces, such as British Columbia, Ontario, and Quebec, which tend to be early adopters of climate-related policies and have a higher capacity. This ultimately constrains the geographic representativeness in this study. Although sustainability reports describe an organization's existing initiatives and future goals, they avoid discussing the challenges involved in integrating these practices. This absence of information constitutes a limitation, as the reports do not indicate the barriers encountered. Using different methods allowed us to capture a range of findings, but the structural difference in the types of firms captured through the document analysis and interviews introduced a bias into the analysis. Furthermore, written corporate and sustainability reports are inherently selective and constrained, as they rely on predefined frameworks that dictate what information is presented and how it is structured. They are also limited in length for readability purposes, often using carefully chosen language to convey a positive narrative. Semi-structured interviews offer greater openness and flexibility, allowing participants to elaborate freely and ensuring that their responses are not reformulated or filtered through predefined categories.

The research provides a foundation for future studies on climate change adaptation in the private residential sector, where empirical cases could explore the outcomes of adaptation measures. Most studies (like this one) look at the why, what and how adaptation in integrated within the private sector; however, few look at adaptation from a longitudinal perspective to see if there is fundamental change. Adaptation is still a relatively new concept and underexplored; however, given the evidence that some private residential developers are adapting in Canada, it is important to evaluate how their adaptation choices hold up over time and whether they have

actually fulfilled their intended purpose. Furthermore, as some efforts to integrate climate change adaptation into operations are driven by market demand and projected market trends, this research highlights the potential for maladaptive outcomes like green gentrification, an issue that is likely to gain greater attention and awareness as the development industry increasingly adopts sustainable development practices. Investigating how adaptation measures (e.g., specific design standards) may inadvertently contribute to displacement, rising housing costs, or unequal access to green infrastructure will be essential in ensuring that climate resilience efforts remain equitable and inclusive. Identifying the barriers of climate change and the moral imperatives of large firms would be worth exploring to gain a richer insight into the reality of these firms and a deeper understanding of the decisions tied to specific measures. Sustainability/ESG reports represent a form of salesmanship and are structured to highlight accomplishments and future objectives. The National Building Code (NBC) was published on December 22nd, 2025, where new regulations include adaptation-related measures related to overheating in indoor environments and a stronger emphasis on retrofitting existing buildings. The standards will incorporate updated climatic data and a review of seismic hazard disaggregation. Evaluating the effectiveness of adaptation-related codes would be a relevant avenue given the lack of regulatory pressures that was highlighted as a prevalent barrier in these findings. Future research should also explore the use of different reporting frameworks for data collection (e.g., Global Reporting Initiative, Task Climate Force Disclosure, Carbon Disclosure Project), though many of these frameworks are voluntary and lean heavily toward the financial dimensions of sustainability (Goldstein et al., 2019). In the absence of a uniform and comprehensive standard for integrating sustainability and climate-related practices, examining why organizations select specific frameworks can offer insight into their priorities, internal capacities, and decision-making

processes. Lastly, given the lack of a clear definition of adaptation, a comprehensive study like Keenan et al. (2015) would allow an in-depth evaluation how the industry defines adaptation, which would be useful, especially since the industry often overlooks differences between acute and chronic climate risks. Understanding this distinction can help clarify how firms prioritize and implement different types of interventions.

5.1 Adaptation outcomes and risks of maladaptation in the development industry

Understanding adaptation outcomes is crucial to understanding the quality of its nature, ensuring that these measures serve their role of protecting residents and communities. Emerging literature signals concerns about potential maladaptive impacts of common approaches to urban climate adaptation, like green gentrification and urban green grabbing (Garcia-Lamarca et al., 2021). Sustainable buildings often command higher property values and rental premiums (Yeganeh et al., 2024). Additionally, firms recognize the growing demand for climate-resilient buildings from governments, financial institutions, and consumers (Avison Young, 2025; Dsouza, 2024). In this research, for some industry professionals, the integration of adaptation measures is seen as a marketing tool and opportunity to increase project value or add price premiums rather than a genuine commitment to climate resilience. While some projects do incorporate meaningful adaptation strategies, others may offer misleading or superficial features that do not deliver on their claims. Furthermore, through the addition of green design standards and certifications, developers see this as the potential to market these projects as luxurious and sustainable. Many interviewees emphasized that the majority of their climate adaptation efforts are concentrated on external measures. For example, design standards commonly include landscape modifications or site planning strategies.

This suggests a prevailing emphasis on physical and visible interventions, while internal organizational changes such as staff training or long-term planning remain less prioritized. This echoes Tubridy's (2020) argument that the prioritization of highly visible green infrastructure is often performative, emphasizing aesthetics and elite consumption. As a result, such projects can mask underlying processes of gentrification and neoliberal urbanization, serving more as cultural justifications for exclusionary, profit-driven urban greening than as efforts to advance genuine sustainability. Several examples of greenwashing in the construction industry were highlighted in the Finnish *Rakennuslehti* (Tähkänen, 2023), such as:

- A project claiming to be "low carbon" without disclosing the baseline for comparison
- Marketing a product's environmental benefits by emphasizing a single feature while ignoring the broader impact
- Using industry-wide average emissions data rather than company-specific figures
- Highlighting sustainability claims that depend heavily on end-user behaviour, such as energy or material efficiency

Furthermore, the concepts of green gentrification and urban green grabbing are often associated with greenwashing, which reflects potential maladaptive outcomes in implementing adaptation. Green gentrification represents the environmental upgrades leading to socio-economic shifts, this results in displacements due to rising costs. It is defined by Anguelovski et al. (2019) as: "[N]ew or intensified urban socio-spatial inequities produced by urban greening agendas and interventions, such as greenways, parks, community gardens, ecological corridors, or green infrastructure." On the other hand, urban green grabbing represents the control/privatization of green or public land, resulting in loss of public access or land rights (Garcia-Lamarca et al., 2022). As previously highlighted in the literature review, the rise of green and resilient design comes with competing interests, which often promote the social and physical

exclusion of certain groups (Tubridy, 2020). For example, developers often use rezoning laws and tax incentives to convert vacant land into high-end housing near green spaces (Anguelovski et al., 2019).

When we consider these outcomes and turn to Canada, the country is already experiencing a housing crisis and a climate crisis, which have been shown to have intersecting effects (Ness et al., 2025). Canada's ongoing housing struggles risks worsening issues like housing insecurity and neighbourhood gentrification (Planas-Carbonell et al., 2023). Enabling these maladaptive outcomes could hinder any progress tied to adaptation and further complicate the housing crisis, widening climate and housing inequities, all while increasing vulnerability among marginalized communities (United Nations, 2023).

5.2 Policy recommendations

Recommendation 1: Develop clear policy goals, frameworks, and regulations that encourage or mandate residential developers to address key climate risks in housing projects.

Adaptation progress in the development industry is constrained by unclear national and regional adaptation goals and priorities, nonexistent policy measures and actions, fragmented governance, and an absence of guidance on progress measurement. Net-Zero targets offer a useful precedent for how climate adaptation could be more systematically integrated into the housing sector both broadly and within new residential development. As efforts intensify to transition toward more sustainable design and practices, a growing culture has emerged around achieving Net-Zero. This shift is reinforced by emerging Net-Zero standards, which provide clearer guidance and common expectations for organizations. In Canada, increased political visibility and prioritization supported by a clear agenda to reach Net-Zero emissions by 2050 further help define concrete goals and objectives for this transition. Historically, mitigation has

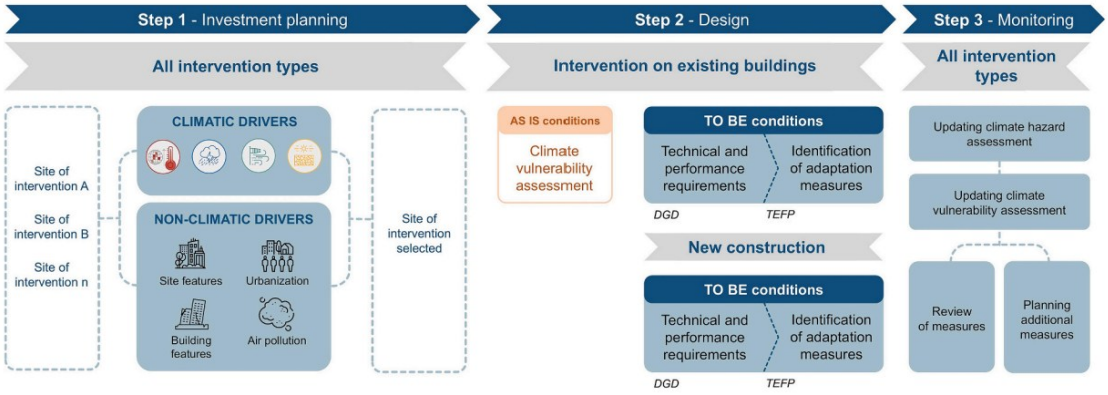
been prioritized. Since 2016, the country has allocated $41.8 billion to fund mitigation measures, including solutions to reduce greenhouse gas emissions and the development of electric vehicles (Stewart, 2024). For businesses, measuring their greenhouse gas emissions, tracking reductions over time, and setting clear targets is quantifiable which is why the majority of the ESG, or sustainability report focus on this data with little to no mention of resilience and adaptation.

This national momentum to decarbonize buildings has been spotlighted by BC Housing as an opportunity to also build more resilient housing in the province. Aligning the Net-Zero and adaptation agendas could ensure that buildings being upgraded or constructed for net-zero performance are also prepared for the increasingly severe climate conditions expected in the coming decades. Decarbonization and resilience rely on many of the same foundations, such as updated policies, new funding mechanisms, workforce training, and innovation. Current climate-mitigation efforts create a unique opportunity to embed resilience at the same time (BC Housing, 2024).

Apreda et al. (2025) propose a novel climate adaptation framework designed to support public authorities and industry in making climate-resilient investment and design decisions across the entire building life cycle (Figure 3). As promoted by this framework, regulations should mandate firms to conduct a vulnerability and climate risk assessment for every new project to ensure homes are built in a safe location. A vulnerability assessment would help to identify the different types of climate risks that a project would be affected by, and the likelihood of the impacts to occur. A climate risk assessment would help identify levels of exposure and sensitivity. Together, these assessments would provide a more comprehensive understanding of the site's conditions, thereby informing decision-making and encouraging the integration of appropriate adaptation measures. The framework also includes a list of adaptation measures that

could be included. This would help facilitate the integration of adaptation while fostering flexibility in addressing place-specific adaptation needs, rather than promoting a one-size-fits-all approach. Given the industry's resistance to change, pushback to this can be expected, as many could consider this framework as additional steps that could extend the approval process for new projects.

Figure 3: Climate assessment framework for planning and designing interventions to enhance real estate adaptation of public real estate to climate change



Source: Apreda et al., 2025

Recommendation 2: Implement policies that encourage or mandate training and education programs for both current and future industry professionals could help stakeholders stay informed on best practices and emerging adaptation strategies.

Given the current housing crisis, the country has set ambitious goals and strategies to ensure affordable and safe homes. The CMHC has estimated that a total of 5.8 million new homes are needed by 2030 to address the overall housing shortfall (Pomeroy, 2024). With that being said, it is crucial to be mindful of factors such as the materials, design, landscaping, and location of new homes, while also acknowledging how current realities shape affordability and

accessibility for different socio-economic groups. As it stands, the curriculum and training of the Canadian construction industry do not include any climate or sustainable related course work. Most programs related to green construction are self-regulated and typically involve continuous learning to earn credits to maintain a professional designation. Recommendation 12 of the *Realizing Resilient Buildings in B.C. Discussion Paper* proposes the integration of climate risk and adaptation in professional competencies and development. By including risk assessment and response in professional development competencies, and in post-secondary program as well as support through the provision of resources and engagement with industry associations. In the future, the program should become standard practice; alternatively, policies should mandate participation from both current and future professionals.

Recommendation 3: Municipalities should introduce fast-tracking incentives for projects that incorporate adaptive measures.

Some participants have raised the fact that building approval processes are lengthy, as procedures are more complex due to the requirements associated with various sizes and types of homes. Reducing processing times for projects that include adaptive measures could encourage developers to address relevant local risks by incentivizing them to regularly integrate relevant measures. Projects that include a greater number of these measures would benefit from shorter wait times. Additionally, this system should automatically grant eligibility for relevant funding programs and incentives, allowing these projects to bypass lengthy bureaucratic processes. Although not a fast-tracking system, in 2022, the Toronto Green Standard (TGS) integrated the Development Charge Refund. This system aligns with the city's commitment to achieve net-zero emissions by 20230 or sooner by providing incentives and refunds for projects to accelerate greater uptake sustainable design (Chopson, 2025; City of Toronto, n.d).

5.3 Concluding thoughts

I believe the recommendations above would help to create an adaptation "culture" within the development industry by providing solutions to make their work easier while encouraging mindful building. While routines will be altered, they will be geared towards greater safety and security for all. A combination of soft and hard policies related to building codes, training, and education needs to be brought on board to strengthen the industry's adaptive capacity.

Efforts to adapt to climate change are required by both governments and the private sector. While the development industry is resistant to change due to entrenched practices, given the severity of climate change, ambitious objectives are required to safeguard homes and those who live in them. I would like to conclude this thesis with a quote that emerged during my data collection. In interviews, two participants (a CEO of an industry association and a lead architect and founder, 2024) expressed a similar sentiment, both with a sense of optimism: "[Adaptation] is building science, not rocket science." This remark underscores that adaptation is both realistic to implement and urgently needed to ensure that homes are prepared for emerging risks. Strengthening adaptation in the residential sector extends its benefits well beyond the fenceline, shaping the resilience of cities, communities, and entire value chains. The participants' reflections suggest that adaptation is not an inherently complex concept. Within the industry, integrating climate change adaptation into everyday operations is feasible, driven either by mounting pressures or by a genuine commitment to adapting a standard practice in the Canadian residential sector.

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Appendices

Appendix A

Survey invitation emails

Hello,

My name is Frédérique Hébert-Mondragon and I am a graduate student in the Department of Geography, Planning and Environment at Concordia University. I am conducting a study on climate change risks and opportunities for resilience-building in the Canadian real estate development industry.

I am reaching out today to see if you would be able to complete a survey questionnaire regarding this topic. If you would like to participate as a representative of your firm and industry, please complete the survey (link below) at a time that is convenient for you. The survey will remain open until March 31st, 2024.

Any information that could be used to identify you will be kept confidential, and results will be aggregated in such a way that your identity will be anonymous to the public. Your personal information is only requested in case the research team needs to contact you with any follow-up information, such as the sharing of our findings.

It is expected that the survey will take around 30 minutes to complete. Questions focus on what climate change-related risks and impacts you perceive to be relevant to the real estate development industry in Canada, and how you see prospects for resilience-building, including barriers or constraints, within the industry. Additional details of the study are included in the Information and Consent form, which is attached here and included at the beginning of the survey.

If you require any additional information to assist you in reaching a decision about participation, please do not hesitate to contact me (contact information attached).

Please click here to access link: https://forms.gle/iCZUqZkP9JxA4Na56

I look forward to your input.

Sincerely,

Frédérique A. Hébert-Mondragon
C-CCAL: https://www.climatechangeadaptationlab.ca/
Department of Geography, Planning, and Environment
Concordia University

First follow-up email

Good afternoon,

In December you received an invitation to participate in a survey regarding climate change risks and opportunities for resilience-building in the Canadian real estate development industry that is being conducted by researchers at Concordia University. If you would like to participate, you may access the survey through the link below. The survey will remain open until March 31st, 2024.

It is expected that the survey will take around 30 minutes to complete. Questions focus on what climate change-related risks and impacts you perceive to be relevant to the real estate development industry in Canada, and how you see prospects for resilience-building, including barriers or constraints, within the industry. Additional details of the study are included in the Information and Consent form, which is attached here and included at the beginning of the survey. Any information that could be used to identify you will be kept confidential, and results will be aggregated in such a way that your identity will be anonymous to the public. Your personal information is only requested in case the research team needs to contact you with any follow-up information, such as the sharing of our findings.

If you have any questions or would like any additional information, please do not hesitate to contact me or the project lead Dr. Alexandra Lesnikowski (alexandra.lesnikowski@concordia.ca).

Please click here to access the survey link: https://forms.gle/iCZUqZkP9JxA4Na56

We look forward to your input.

Sincerely,
Frédérique A. Hébert-Mondragon
C-CCAL: https://www.climatechangeadaptationlab.ca/
Department of Geography, Planning, and Environment
Concordia University

Second follow-up email

Good afternoon,

My name is Frédérique Hébert-Mondragon and I am a graduate student in the Department of Geography, Planning and Environment at Concordia University working under the supervision of Dr. Alexandra Lesnikowski. My research is focused on climate change risks and opportunities for resilience-building in the Canadian real estate development industry.

I am reaching out today to see if you would be able to complete a survey questionnaire regarding this topic. Your contact information was identified through the main page of the Canadian Home Builders' Association. If you would like to participate as a representative of your firm, please complete the survey (link below) at a time that is convenient for you. The survey will remain open until June 30, 2024. Any information that could be used to identify you will be kept confidential, and results will be aggregated in such a way that your identity will be anonymous to the public. Your personal information is only requested in case the research team needs to contact you with any follow-up information, such as the sharing of our findings.

It is expected that the survey will take around 30 minutes to complete. Questions focus on what climate change-related risks and impacts you perceive to be relevant to the real estate development industry in Canada, and how you see prospects for resilience-building, including barriers or constraints, within the industry. Additional details of the study are included in the Information and Consent form, which is attached here and included at the beginning of the survey.

If you require any additional information to assist you in reaching a decision about participation, please do not hesitate to contact me (contact information below).

Please click here to access link: https://forms.gle/iCZUqZkP9JxA4Na56

I look forward to your input.

Sincerely,
Frédérique A. Hébert-Mondragon
Concordia Climate Change Adaptation Lab (C-CCAL):
https://www.climatechangeadaptationlab.ca/
Department of Geography, Planning, and Environment
Concordia University

Appendix B

Information and Consent Form

Study Title: Climate change adaptation: An analysis of Canadian residential housing developers
Principal Investigator: Dr. Alexandra Lesnikowski
Principal Investigator's Email: alexandra.lesnikowski@concordia.ca
Student Researcher: Frédérique Hébert-Mondragon
Student Researcher's Email: frederique.hebert-mondragon@mail.concordia.ca
Principal Investigator's Contact Information: (514) 848-2424 ext. 7314 Email: alexandra.lesnikowski@concordia.ca
Source of funding for the study: Social Sciences and Humanities Research Council of Canada

You are being invited to participate in the research study mentioned above. This form provides information about what participating would mean. Please read it carefully before deciding if you want to participate or not. If there is anything you do not understand, or if you want more information, please ask the researcher.

A. PURPOSE

The purpose of the research is to assess the prospects for fostering resilience to climate change within the Canadian real estate development industry and broadly explore the intersection between climate change adaptation and residential real estate development. The study seeks to better understand how risks are perceived by developers, what role developers see for themselves in adapting to key risks, and what barriers, constraints, and opportunities face the industry in adapting business operations to climate change.

B. PROCEDURES

If you participate, you will be asked to complete an online survey regarding climate change risks and opportunities for resilience-building in the Canadian real estate development industry. The survey is administered via the application Google Forms.

In total, participating in this study will take 25-30 minutes. You may be contacted for an optional follow-up interview at a later date. If selected for a follow-up interview you will be notified via email, at which time you may accept or decline the invitation.

C. RISKS AND BENEFITS

There are no clearly identifiable risks associated with participating in this research. This research is not intended to benefit you personally.
The scientific and scholarly benefits of this research include an understanding of how the residential real estate industry perceives climate risk and their own responsibility to adapt to a changing climate, as well as insight into how the industry is contributing to adaptation implementation. This information will support the design of policies and programs to protect people and housing infrastructure from accelerating climate risks.

D. CONFIDENTIALITY

We will not allow anyone to access the information you provide in this survey, except people directly involved in conducting the research. The survey is administered by myself, Dr. Alexandra Lesnikowski, and will be analyzed by Frédérique Hébert-Mondragon; a graduate student under my supervision. We will only use the information for the purposes of the research described in this form.

The information gathered, which includes general information about your firm and your perceptions regarding climate change adaptation and the real estate sector, will be confidential. That means the researchers will be able to make a link between you and the information you provide, but your identity will be at no point disclosed to anyone outside the research team.

All results of the survey will be archived in an encrypted, password-protected folder on the secure Concordia University OneDrive storage platform. Only the researchers will have access to the archived files. All information gathered from the surveys will be destroyed ten years after the completion of the study.

The results of this research will be reported in the graduate student researcher's thesis and we intend to publish the results of the research in a peer reviewed journal. We intend to publish the results of the research in a peer reviewed journal. However, it will not be possible to identify you in the published results.

E. CONDITIONS OF PARTICIPATION

Your participation in this research is purely voluntary and if you do choose to participate you may stop the survey at any time. You can also ask that the information you provided not be used, and your choice will be respected. If you decide that you don't want us to use your information, you must tell the researcher before August 31, 2024.

There will be no negative consequences for choosing to not participate, halting the survey early, or asking us not to use your information.

F. PARTICIPANT'S DECLARATION

If you have questions about the scientific or scholarly aspects of this research, please contact the researcher. Their contact information is on page 1. You may also contact their faculty supervisor. If you have concerns about ethical issues in this research, please contact the Manager, Research Ethics, Concordia University, 514.848.2424 ex. 7481 or oor.ethics@concordia.ca.

If you have any additional questions or concerns about participating in this survey, please contact the research team using the above contact information before initiating.

Appendix C

Search string applied to the grey literature search of the Canada Commons and Google Advanced Search

Search String	***Number of results***	***Filters***
1. (Housing OR residential) AND 'climate change adaptation'	2 results	2014-2024 -Publisher type: Corporation, Government, Higher Education, IGO, NGO, Non-profit, Project, Research center -Publication type: Administrative document or Article, Assessment, Proceedings, Report, Statistical publication, Toolkit/How-to -Language: English or French -Country: Canada -Topics: Climate change, households
2. (Housing OR Residential) AND 'climate change adaptation' AND Canada	2 results	-2014-2024 -Publisher type: Corporation, Government, Higher Education, IGO, NGO, Non-profit, Project, Research center - Publication type: Administrative document, Article, Assessment, Proceedings, Report, Toolkit/How-to -Language: English, French -Country: Canada -Topics: Climate change, households, housing
3. (Housing OR residential) AND ('climate change adaptation' OR 'Adaptive Capacity') AND Canada	311 results	-2014-2024 -Publisher type: Corporation, Government, Higher, IGO, NGO, Research center -Publication type: Administrative document, Article, Assessment, Proceedings, Report -Language: English French

		-Country: Canada -Topics: Climate change, housing
4. 'climate change adaptation' AND ('real estate' OR housing) AND Canada	221 results	- 2014-2024 -Publisher type: Corporation Government, IGO, NGO, Non-profit -Publication type: Administrative document, Article, Assessment, Proceedings, Report, Statistical publication -Language: English, French -Country: Canada -Topics: Climate change, housing
5. 'climate change adaptation' AND 'Adaptive Capacity' AND ('Real Estate' OR Housing) AND Canada	88 results	-2014-2024 -Publisher type: Corporation, Government, IGO, NGO -Publication type: Administrative document, Assessment, Proceedings, Report -Language: English, French -Country: Canada -Topics: Climate change, housing
6. 'Climate change adaptation' AND 'adaptive capacity' AND 'real estate' AND housing AND Canada	16 results	-2014-2024 -Publisher type: Corporation, Government, IGO, NGO -Publication type: Administrative document, Assessment, Proceedings, Report -Language: English, French -Country: Canada -Topics: Climate change, housing
7. 'Climate change adaptation' AND 'adaptive capacity' AND 'real estate' AND Canada	17 results	- 2014-2024 -Publisher type: Corporation, Government, IGO, NGO -Publication type: Administrative document, Assessment, Proceedings, Report

		-Language: English, French -Country: Canada -Topics: Climate change, housing
8. ('climate change adaptation' OR 'adaptive capacity') AND 'real estate' AND Canada	174 results	- 2014-2024 -Publisher type: Corporation, Government, IGO, NGO, Research Center -Publication type: Administrative document, Assessment, Proceedings, Report, Regulation -Language: English, French -Country: Canada -Topics: Climate change, housing
9. Climate change adaptation AND resilience AND housing AND construction AND residential AND climate change	92 results (without year) 24 results (2014-2024)	-Publisher type: Corporation, Government, IGO, NGO, Research center -Publication type: Administrative document, t, Proceedings, Report -Language: English, French -Country: Canada -Topics: Climate change, housing
10. (Climate change OR Adaptive Capacity) AND (housing OR Residential OR real Estate)	136 results	- 2014-2024 -Publisher type: Corporation, Government, IGO, NGO -Publication type: Administrative document, Proceedings, Report -Language: English, French -Country: Canada -Topics: Climate change, housing
11. (Climate change OR Adaptive Capacity) AND (Housing OR Residential	138 results	- 2014-2024 -Publisher type: Corporation, Government, IGO, NGO

OR Real Estate) AND Canada		-Publication type: Administrative document, Assessment, Proceedings, Report -Language: English, French -Country: Canada -Topics: Climate change, housing

Appendix D

Survey available via GoogleForms

Real Estate Development and ClimateChange Survey Questionnaire
Study Title: Climate change adaptation and the Canadian real estate development industry
Principal Investigator: Dr. Alexandra Lesnikowski
Principal Investigator's Contact Information: (514) 848-2424 ext. 7314
Email: alexandra.lesnikowski@concordia.ca
Source of funding for the study: Social Sciences and Humanities Research Council ofCanada

You are being invited to participate in the research study mentioned above. This form provides information about what participating would mean. Please read it carefully before deciding if you want to participate or not. If there is anything you do not understand, or if youwant more information, please ask the researcher.

PURPOSE

The purpose of the research is to assess the prospects for fostering resilience to climate change within the Canadian real estate development industry and broadly explore the intersection between climate change adaptation and residential real estate development. The study seeks to better understand how risks are perceived by developers, what role developers see for themselves in adapting to key risks, and what barriers, constraints, and opportunities face the industry in adapting business operations to climate change.

PROCEDURES

If you participate, you will be asked to complete an online survey regarding climate change risks and opportunities for resilience-building in the Canadian real estate development industry. The survey is administered via the application Google Forms.

In total, participating in this study will take 25-30 minutes.

You may be contacted for an optional follow-up interview at a later date. If selected for a follow-up interview you will be notified via email, at which time you may accept or decline the invitation

RISKS AND BENEFITS

There are no clearly identifiable risks associated with participating in this research.This research is not intended to benefit you personally.

The scientific and scholarly benefits of this research include an understanding of how the residential real estate industry perceives climate risk and their own responsibility to adapt to a changing climate, as well as insight into how the industry is contributing to adaptation implementation. This information will support the design of policies and programs to protect people and housing infrastructure from accelerating climate risks.

CONFIDENTIALITY

We will not allow anyone to access the information you provide in this survey, except people directly involved in conducting the research. The survey is administered by myself, Dr. Alexandra

Lesnikowski, and will be analyzed by Frédérique Hébert-Mondragon; a graduate student under my supervision. We will only use the information for the purposes of the research described in this form.

The information gathered, which includes general information about your firm and your perceptions regarding climate change adaptation and the real estate sector, will be confidential. That means the researchers will be able to make a link between you and the information you provide, but your identity will be at no point disclosed to anyone outside the research team.

All results of the survey will be archived in an encrypted, password-protected folder on the secure Concordia University OneDrive storage platform. Only the researchers will have access to the archived files. All information gathered from the surveys will be destroyed ten years after the completion of the study.

We intend to publish the results of the research in a peer reviewed journal. However, it will not be possible to identify you in the published results.

CONDITIONS OF PARTICIPATION

Your participation in this research is purely voluntary and if you do choose to participate you may stop the survey at any time. You can also ask that the information you provided not be used, and your choice will be respected. If you decide that you don't want us to use your information, you must tell the researcher before August 31, 2024.

There will be no negative consequences for choosing to not participate, halting the survey early, or asking us not to use your information.

PARTICIPANT'S DECLARATION

If you have questions about the scientific or scholarly aspects of this research, please contact the researcher. Their contact information is on page 1. You may also contact their faculty supervisor. If you have concerns about ethical issues in this research, please contact the Manager, Research Ethics, Concordia University, 514.848.2424 ex. 7481 or oor.ethics@concordia.ca.

If you have any additional questions or concerns about participating in this survey, please contact the research team using the above contact information before initiating.

I have read and understood this form. I have had the chance to ask questions and any questions have been answered. I agree to participate in this research underthe conditions described.

- Yes
- No

Background Information

1) Please enter the name of your development firm and/or your role within thecompany:

_____

2) How many years of experience do you have in the field of residentialdevelopment?

_____

3) What type of firm do you currently work for?

- Private corporation
- Non-profit / Co-op
- Municipal corporation
- Other: _____

4) How would you describe the size of your development firm (in terms of relativevolume of unit production or portfolio managed)?

- Small
- Medium
- Large

5) What sub-market of residential development does your firm focus on? (select allthat apply)

- Single/detached
- Row House
- Duplex
- Apartment less than 5 stories
- Apartment more than 5 stories
- Mixed use developments
- Other: _____

6) What regions does your business operate in? (select all that apply)

- Alberta
- British Columbia
- Manitoba
- New Brunswick
- Newfoundland & Labrador

- Northwest Territories
- Nova Scotia
- Nunavut
- Ontario
- Prince Edward Island
- Saskatchewan
- Québec
- Yukon

Climate Change Risks & Impacts

Climate change 'risks' here refer to the impacts of climate change, such as increased floodingor wildfires.

7) Our firm discusses risks posed by climate change to business activities and realestate portfolio:

1= Frequently 2= Occasionally 3= A few times 4= Once 5= Never

7b) Additional comments (optional):

8) What climate change hazards have been discussed as most pertinent to yourdevelopment operations? (select all that apply)

- Sea level rise (including storm surges and coastal flooding)
- Extreme precipitation and inland flooding
- Storms
- Drought
- Wildfires
- Erosion and landslides
- Extreme heat events
- Extreme colds
- Water Security
- None of the above
- Other: _____

9) Climate change or environmental issues have had an impact on your firm’splanning and residential development projects to date

1=Strongly agree 2=Agree 3=Unsure 4=Disagree 5=Strongly disagree

9b) Additional comments (optional):

10) Our firm anticipates that climate change will have a significant impact on futureplanning and residential development projects

1=Strongly agree 2=Agree 3=Unsure 4=Disagree 5=Strongly disagree

10b) Additional comments (optional):

11) What areas of your operations do you expect climate change to impact? (selectall that apply)

- Development site
- Location
- Type of build
- Choice of contractors / development / investment partners
- Approval processes
- Overall productivity and efficiencyProfitability
- Design standards
- None
- Other: _____

12) What level of action has been taken to date by your firm to prepare for climatechange impacts?

- Preliminary discussions
- Decision-making and strategic planning
- Implementation of policies, actions, or strategies

Decision-making and Information

13) Does your firm base any decision-making regarding development proposalsand risk assessment on scientific or other formal information related to climate change?

- Yes
- No
- Unsure

14) What source of scientific information or data have you received or sought outregarding climate change to inform decision-making around development and climate change risks? (select all that apply)

*Many answers possible

- Municipal development guidelines or strategic planning documents
- Provincially sourced or provided climate information
- Federally sourced or provided climate information
- NGOs or non-profit interest/research groups
- Insurance sector
- Private sector / contracted researchers
- Specialist advisors
- Scientific Research journals
- None
- Other: _____

Collaboration and Adaptation Planning

15) Has your firm coordinated with government, industry, or NGO partners todevelop climate resilience plans?

- Yes
- No
- Unsure

15b) What category would these partners fall under (select all that apply):

- Government agencies
- Publicly funded organizations
- Development industry / private consultants or firms NGO or non-profit organizations
- Other: _____

Collaboration and stakeholder engagement

16) Have industry groups (e.g. ULI, CHBA) played a role in facilitating action or information regarding climate change risks and strategies to improve resilience ofthe sector?

- Yes
- No
- Unsure

17) Government planning or policies related to climate change have impacted yourfirm's development activities.

1=Strongly agree 2=Agree 3=Unsure 4=Disagree 5=Strongly disagree

17b) Additional comments (optional):

18) Government policies have helped your industry prepare for climate changeimpacts and address key risks to the sector.

1=Strongly agree 2=Agree 3=Unsure 4=Disagree 5=Strongly disagree

18b) Additional comments (optional):

19) Government policies have hindered efforts in your industry to prepare forclimate change and address key risks to the sector.

1= Frequently 2= Occasionally 3= A few times 4= Once 5= Never

19b) Additional comments (optional):

20) Has there been any contact, directly or indirectly, between your firm and provincial or local government regarding climate change policy as it effects the realestate industry?

- Yes
- No
- Unsure

21) Have you or has your firm had any interaction with climate change adaptationplanners at municipal or provincial levels of government during the development process for any project?

- Yes
- No
- Unsure

Climate Action

22) What barriers or constraints do you perceive in efforts for your industry to adaptto risks presented by climate change? (select all that apply)

- Lack of financing for adaptation/resilience measuresUnacceptable costs / strain on capital
- Lack of leadership
- Lack of relevant/usable information to inform decision-makingLow support from industry professionals
- Other: _____

23) In your opinion, how should potential costs and responsibilities for implementingclimate change resilience measures in real estate development best be distributed?Referring for example, to responsibility sharing between the private and public sector (explain briefly).

24) From your experience, is the development industry active on addressingclimate resilience issues?

- Yes
- No
- Unsure

24b) If Yes, please briefly describe how industry representatives are engaging on climate resilience issues.

25) Relative to other strategic goals, how much of a priority is adapting your firm'soperations to key risks associated with climate change (flooding, extreme heat, more extreme storms etc.)?

1= Urgent 2= High priority 3= Medium priority 4= Low priority 5= Not on the agenda

25b) Additional comments (optional):

26) Throughout the residential development industry in general, how much of a priority would you estimate adapting operations to key risks associated with climatechange is?

1= Urgent 2= High priority 3= Medium priority 4= Low priority 5= Not on the agenda

26b) Additional comments (optional):

27) In your opinion, what key actions are needed to improve climate resilience forthe residential real estate development sector?

28) Is there anything else you would like to add regarding the issue of climatechange and development?

Appendix E

Email invitation for interviews

Group 1

Good afternoon,

In December 2023, you received an invitation to participate in a survey regarding climate change risks and opportunities for resilience-building in the Canadian real estate development industry that is being conducted by researchers at Concordia University. We would like to invite you to a follow-up interview. As a member of the Urban Land Institute, your input would greatly contribute to the depth and quality of our research.

It is expected that the interview will take around 45-60 minutes to complete. Similarly to the survey, questions focus on what climate change-related risks and impacts you perceive to be relevant to the real estate development industry in Canada, and how you see prospects for resilience-building, including barriers or constraints, within the industry. Additional details of the study are included in the Information and Consent form, which is attached here. Your participation is entirely voluntary, and you may withdraw at any time. Any information that could be used to identify you will be kept confidential, and results will be aggregated in such a way that your identity will be anonymous to the public. Your personal information is only requested in case the research team needs to contact you with any follow-up information, such as the sharing of our findings.

If you have any questions or would like any additional information, please do not hesitate to contact me or the project lead Dr. Alexandra Lesnikowski (alexandra.lesnikowski@concordia.ca).

***This research is being conducted independently by researchers at Concordia University with funding from the Social Science and Humanities Research Council of Canada and is not associated with ULI/CHBA**

We look forward to your input.

Sincerely,

Frédérique A. Hébert-Mondragon

C-CCAL: https://www.climatechangeadaptationlab.ca/

Department of Geography, Planning, and Environment

Concordia University

Group 2

Good afternoon,

In July, you received an invitation to participate in a survey regarding climate change risks and opportunities for resilience-building in the Canadian real estate development industry that is being conducted by researchers at Concordia University. We would like to invite you to a follow-up interview. As a member of the Canadian Home Builders Association, your input would greatly contribute to the depth and quality of our research.

It is expected that the interview will take around 45-60 minutes to complete. Similarly to the survey, questions focus on what climate change-related risks and impacts you perceive to be relevant to the real estate development industry in Canada, and how you see prospects for resilience-building, including barriers or constraints, within the industry. Additional details of the study are included in the Information and Consent form, which is attached here. Your participation is entirely voluntary, and you may withdraw at any time.

Any information that could be used to identify you will be kept confidential, and results will be aggregated in such a way that your identity will be anonymous to the public. Your personal information is only requested in case the research team needs to contact you with any follow-up information, such as the sharing of our findings.

If you have any questions or would like any additional information, please do not hesitate to contact me or the project lead Dr. Alexandra Lesnikowski (alexandra.lesnikowski@concordia.ca).

***This research is being conducted independently by researchers at Concordia University with funding from the Social Science and Humanities Research Council of Canada and is not associated with ULI/CHBA**

We look forward to your input.

Sincerely,

Frédérique A. Hébert-Mondragon

C-CCAL: https://www.climatechangeadaptationlab.ca/

Department of Geography, Planning, and Environment

Concordia University

Appendix F

Interview Questions

1. Please describe your firm's profile.
    - Follow-up questions: How large an organization is the firm? What types of projects does it undertake?
2. Do you think climate change poses risks to your firm's current or future activities?
    - Follow-up question: What types of impacts are you most concerned about?
3. Do you think climate change poses broader risks for the housing sector or real estate industry?
4. Does your firm integrate climate risk assessments into its activities?
    - Follow-up question: Where do you find information about climate change risks?
5. How will climate change affect the following aspects of your business:
    - Selection of site for future projects
    - The types of projects you undertake
    - Building design or siting
    - General business environment (e.g. profitability, financing, regulatory frameworks)
6. What role do you think the real estate development sector should play in building resilience to a changing climate?
7. What has your firm done to address climate risks in its own portfolio, business operations, or other activities?
8. Can you give an example of a project your firm has done that is designed or constructed in a way to address climate change risks?
9. How can the real estate development sector become more resilient to a changing climate?
10. Do people in your industry have a general awareness of how governments are planning to address the issue of adaptation in the housing sector?
11. Has the industry directly engaged with governments or other actors around specific policies for adapting to a changing climate (for example, during the creation of the National Adaptation Strategy or your province's adaptation strategy)?
12. Has anyone from your firm specifically engaged with industrial representatives, governments, or other actors around the issue of adapting to a changing climate (for

example, during the creation of the National Adaptation Strategy or your province's adaptation strategy)?

13. Who do you think are the leading industry voices on climate resilience issues?
14. What do you think is the role of industry groups like the Urban Land Institute or the Canadian Homebuilders Association in informing climate resilience policies or planning?
15. What barriers do you think the industry faces to building resilience to climate change?
16. What barriers do you think your firm faces to building resilience to climate change?
17. How do you think the costs of resilience-building should be shared among public and private actors?
18. What role should government play in supporting resilience-building in the housing sector and real estate industry?