The Political Economy of Road Freight Decarbonization: Policy Implications for Governing Canada's Roads

by

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FOREWORD

"People everywhere – under very different conditions – are asking themselves – where are we? The question is historical not geographical. What are we living through? Where are we being taken? What have we lost? How to continue without a plausible vision of the future? Why have we lost any view of what is beyond a lifetime?

– John Berger, *Hold Everything Dear*

The seeds of this thesis were planted by two experiences.

The first was working with logistics operators to help them find suitable locations for industrial developments throughout Canada. While working closely with operators, I observed that when one municipality would not have a regulatory framework to allow for logistics and transportation facilities, it was often simply a question of calling the Urban Planning department 500 meters down the road in the neighbouring municipality to find suitable land for development. This was striking – transportation and movement of goods are inherently regional in nature. If you're moving through a region – say Greater Montreal or the Greater Golden Horseshoe – you may cross through multiple municipalities, though your experience of travel is using one network of roads. The same rationale seemed to apply for logistics uses: if you simply moved your prospective facility 500 meters down the road to a permissive municipality, all the risks and opportunities of new industrial development will still be felt by the wider area. I wanted to better understand why government actors wouldn't or couldn't collaborate more meaningfully to manage goods movement.

The second experience happened in the Fall 2021. For years I'd been reading reports from the Intergovernmental Panel on Climate Change (IPCC). Anyone who has read IPCC reports knows that they are dense, technical documents that provide readers with a general sense of the state of the climate and environment globally. Even their Summary for Policymakers is quite dry. I remember sitting at my desk about to start my workday in August 2021 reading about our global moment: we'd been locked into 1.5 degrees of warming, disasters were going to be more damning, and we had 30 years *at most* to course correct. My immediate reaction was anxiety – climate catastrophes were already becoming more common, weather was becoming more unstable, and a growing body of literature was detailing where and how places

around the globe will fall into misery. Within this context, I wanted to better understand how the IPCC reports worked and how they came to their conclusions. Moreover, I wanted to understand how we tackle the industries that were hardest to decarbonize such as freight transportation, resource extraction and production, and energy production. I saw lots of public focus on the ‘low-hanging fruits’ of reaching decarbonization targets, but less discussion of the thornier, less visible parts of our infrastructure landscapes.

As the early pathways of my research wandered, I realized that among the hard to decarbonize industries there was not only a lack of collaboration between municipalities on goods movement, but that there was a dearth in the literature on goods movement, governance, and decarbonization.

The intent of this thesis is to provide a starting point to deeper study of what road freight in Central and Eastern Canada looks like right now and what it could look like in the future. It provides guidance to professional planners, engineers, and politicians so that they may work together more effectively to decarbonize goods movement.

Alexi Katsanis
January 2022 – December 2024
418.13 ppm of CO_2 in 2022 – 426.91 ppm of CO_2 in 2024

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Many people have helped me in thinking through and writing this thesis. I’m the better for all of their help. All mistakes and omissions are my own.

L'économie politique de la décarbonisation du transport routier de marchandises : Implications politiques pour la gestion des routes du Canada

Alexander John KATSANIS

RÉSUMÉ

Cette thèse avance que la décarbonisation du fret routier nécessite d'étudier et de réformer la dynamique sociale du mouvement des marchandises. Le fret routier et la décarbonisation sont actuellement dissociés dans la littérature académique et dans la pratique professionnelle. Le fret routier étant un employeur majeur pour les Canadiens et l'une des plus importantes sources d'émissions de carbone du pays, il est impératif de réaliser une décarbonisation satisfaisante. Pour réussir la décarbonisation, il faut prêter attention à la manière dont les acteurs gouvernementaux collaborent entre eux-mêmes et impliquent les Canadiens dans la gestion du transport routier de marchandises. Le système actuel de gouvernance des transports au Canada est fragmenté, avec une distribution des responsabilités et des pouvoirs entre les acteurs municipaux, provinciaux et fédéraux. L'absence d'un mandat clair de décarbonisation du fret routier au sein des gouvernements risque d'empêcher le Canada d'atteindre ses objectifs en ce qui concerne le climat.

Pour étudier la dynamique sociale du fret routier, cette thèse établit les conditions de base de la gouvernance du fret routier dans le centre et l'est du Canada en utilisant une approche de méthodes mixtes orientée vers les systèmes. Le fret routier est traité comme un sous-système du réseau de transport plus large du Canada. Cette approche inclut des entretiens semi-structurés avec le personnel de planification et d'ingénierie du secteur public en Ontario, au Québec, au Nouveau-Brunswick et en Nouvelle-Écosse, ainsi qu'une étude trans-sectorielle des opinions des résidents sur les efforts des gouvernements, les outils et la collaboration entre les agences. Ces entretiens et enquêtes indiquent que les professionnels et le grand public souhaitent une collaboration plus efficace entre tous les niveaux de gouvernement, et qu'il faudrait en faire plus sur le climat dans le centre et l'est du Canada. En identifiant les conditions de base de la gouvernance du transport routier de marchandises, cette thèse soutient que la décarbonisation et le transport routier de marchandises sont traités de manière distincte, qu'ils se recoupent peu dans la pratique professionnelle, qu'ils sont mal priorisés par les politiciens, qu'ils ne sont pas abordés avec la bonne sélection d'outils, et qu'ils sont mal compris par le personnel public et les résidents.

En abordant les défis et les opportunités soulevés par le personnel public et les résidents Canadiens, cette thèse conclut en proposant une structure de gouvernance alternative pour le fret routier. Orientée vers l'intégration de la décarbonisation dans la planification du transport routier de marchandises, cette structure de gouvernance proposée comprend une taxonomie révisée des pouvoirs, des responsabilités et des capacités des acteurs gouvernementaux, du secteur privé et des résidents. De nouveaux outils et organismes de gouvernance sont proposés afin d'améliorer l'engagement entre les acteurs gouvernementaux et entre les agences gouvernementales canadiennes et les résidents.

Mots-clés : gouvernance des transports, politique climatique, politique des transports, planification du fret, urbanisme, développement régional, changement climatique

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ABSTRACT

This thesis argues that decarbonizing road freight requires studying and reforming the social dynamics of goods movement. Road freight and decarbonization are currently decoupled in both academic literature and professional practice. As road freight is a major employer of Canadians and one of the nation's most significant sources of carbon emissions, it is imperative to get decarbonization right. Getting decarbonization right means paying attention to how government actors collaborate with each other and engage Canadians in managing road freight. Canada's current transport governance landscape is fragmented by the allocation of responsibilities and powers distributed across municipal, provincial, and federal actors. The lack of a clear mission-oriented mandate to decarbonize road freight across governments risks the failure of Canada to meet its climate targets.

To study the social dynamics of road freight, this thesis establishes the baseline conditions of road freight governance in Central and Eastern Canada by using a systems-oriented mixed-methods approach. Road freight is treated as one subsystem of Canada's larger transportation system. This approach includes semi-structured interviews with public sector planning and engineering staff in Ontario, Quebec, New Brunswick, and Nova Scotia, and a cross-sectional study of resident opinions of government efforts, tools, and collaboration between agencies. These interviews and surveys find that both professionals and the general public want to see more effective collaboration between all levels of government, and that more work is needed on climate change in Central and Eastern Canada. In identifying the baseline conditions of road freight governance this thesis argues that decarbonization and road freight are treated as distinct, have little overlap with each other in professional practice, are poorly prioritized by politicians, are not addressed with the right mix of tools, and are poorly understood by residents and public staff.

In addressing the challenges and opportunities raised by public staff and Canadian residents, this thesis concludes by proposing an alternative governance structure for road freight. Oriented towards embedding decarbonization into road freight planning, this proposed governance structure includes a revised taxonomy of powers, responsibilities, and capacities for government actors, the private sector, and residents. We propose new tools and governing bodies that can help improve engagement between government actors and between Canadian government agencies and residents.

Keywords: transport governance, engagement, climate policy, transport policy, freight planning, urban planning, regional development, climate change

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LIST OF ABBREVIATIONS

BEVs	Battery Electric Vehicles
CDPQ	Caisse de dépôt et placement du Québec
CIP	Canadian Institute of Planners
CMM	Communauté métropolitaine de Montréal
CNZEAA	Canadian Net-Zero Emissions Accountability Act
CUTA	Canadian Urban Transit Association
DEA	Data envelopment analysis
EDV	Electric Drive Vehicles
EFVs	Electric Freight Vehicles
FCEVs	Fuel Cell Electric Vehicles
FCM	Federation of Canadian Municipalities
GDP	Gross Domestic Productive
GIS	Geographic Information Systems
HDV	Heavy-Duty Vehicles
ITE	Institute of Transportation Engineers
JRTA	Joint Regional Transportation Agency
LNG	Liquid Natural Gas
LPPANS	Licensed Professional Planners of Nova Scotia
MDZEV	Medium-Duty Electric Vehicles
MPOs	Municipal Planning Organizations
MRC	Municipalités régionales de comté
NETs	Negative Emissions Technologies
NPM	New Public Management

NIMBY	Not In My Backyard
NYSAMPO	New York State Association of Metropolitan Planning Organizations
OECD	Organization for Economic Co-operation and Development
OPPI	Ontario Professional Planners Institute
OUQ	L’Ordre des urbanistes du Québec
R&D	Research and Development
RFI	Rete Ferroviaria Italiana
SCM	Supply Chain Management
STI	Science, Technology, and Innovation
TAC	Transportation Association of Canada

INTRODUCTION

Problem Statement

Road freight is a major driver of the Canadian economy: approximately 5% of Canada's workforce works in road freight transportation and accounts for 4% of Canada's GDP (Fan and Heminthavong, 2022). Road freight is a key source of trade and economic growth for both Canada's broader economy and municipalities (Kim et al., 2023: 16). Within Central and Eastern Canada alone, road freight infrastructure is comprised of two out of three major corridors (the Ontario-Quebec Corridor and the Atlantic Corridor), national, provincial, and municipal roads, and countless logistics facilities (Lawson, 2015; Lightstone et al., 2021).

The importance of road freight is expected to grow. Post-COVID-19 demand for delivery and additional logistics-related industrial development is expected to increase over time (Ghisolfi et al., 2022a). This will have broad implications for not just the Canadian economy, but for the shape of cities, regions, and broader land use patterns.

Road freight accounts for 36.7% of greenhouse gas emissions generated by Canada's transportation system, with emissions expected to climb despite overall emissions reductions in other economic sectors (Fan and Heminthavong, 2022; Dusyk et al., 2021: 4). This poses both a problem and an opportunity for all levels of Canadian government.

Canada's current mix of policies and plans are not sufficient to transition away from a fossil-fuel based economy to a net-zero economy by 2050 in spite of formal commitments to meet ambitious international, national, and local climate targets. This is made more complicated by the complex jurisdictional tensions that exist between municipal, provincial, and federal governments across Canada.

There is currently a wealth of research on the technical dimensions of road freight decarbonization in Canada. There is also rich literature on governance and climate change. To date, there has been a lack of research linking concerns of decarbonization, road freight, and governance. This research aims to fill the gap by linking these three areas of research. It proposes a starting point to study how and why road freight is hard to decarbonize given the wealth of existing technological interventions available for electric vehicles.

The broader argument put forward in this thesis is that there is a need for public sector staff and politicians in Canada to not only prioritize road freight as a major area of intervention, but that future approaches need to embed concerns for climate change. Not only should governments *do more* but Canadians also want their government to take bolder action. As road freight and decarbonization are currently decoupled in both professional practice and in the wider academic literature, this thesis proposes a first step in joining the two realms. Implicit to this line of thinking is the belief that climate change policy is transportation policy and vice-versa. All future approaches to road freight taken by Canadian governments need to consider and be oriented towards decarbonizing goods movement. Accomplishing this requires transforming how residents are involved and participate in governing regional transportation and how government actors collaborate with each other.

The Social Dynamics of Road Freight: A New Research Agenda

This thesis is a study of what we call the social dynamics of road freight. The social dynamics of road freight involve interactions between government actors across municipal, provincial, and federal agencies, as well as relationships with civil society and the private sector. There has been minimal research to date on the social and political dimensions of road freight decarbonization. However, there have been parallel efforts to study the social dynamics of renewable energy infrastructure that we draw on for inspiration (see Hughes, 2021; Walker and Baxter, 2017).

Our approach to studying the social dynamics of road freight is to study how changes to the governance of Canada's transportation system can impact provincial and federal decarbonization efforts. Governance is used as a framework to explore how decarbonization emerges as a priority within a multi-stakeholder transportation system. This transportation system involves Canada's multi-level political and regulatory frameworks that involve municipal, provincial, and federal actors, private market actors, and regional and inter-provincial government agencies. In an environment where public funds are constrained and conflicting goals and values co-exist, understanding how public sector actors behave in regulating their segment of the transportation system is of vital importance to better govern Canada's road freight. Moreover, road freight is simply one subsystem of the larger transportation system. Other relevant subsystems include marine freight, rail freight, passenger travel, and public transit.

Our research takes a systems approach to road freight. Only by focusing on how the many-to-many stakeholder relationships that constitute the road freight subsystem interact can we get a better sense of the existing dynamics between actors and institutions. This holistic approach also allows for consideration of how non-linear government and civil society interventions impact road freight, either directly or indirectly. Road freight decarbonization is a “wicked problem” that will require actors from the public sector, private sector, and civil society to solve. There are no silver bullets that can solve the climate crisis and, by extension, advance road freight decarbonization.

Research Objectives

This research addresses two gaps, one institutional and one academic.

Institutional. Amongst public sector planners and engineers there is a lack of targeted consideration of how to regulate and govern road freight in Canada. Generally, goods movement is divided across distinct departments and agencies, resulting in a patchwork of policies, guidelines, and strategies. This is reflective of a lack of effective inter-agency multi-jurisdictional collaboration.

Academic. There is a lack of research on how the governance of land use, industrial development, and road freight intersect and impact Canada’s decarbonization efforts. Road freight research tends to focus on the technical dimensions of decarbonizing goods movement, rather than the subsystems social and political dimensions. Moreover, much of the current focus of research is on goods movement *within* municipal boundaries, rather than on broader regional road freight. In short, different components of the road freight system are studied in silos and lack a systems lens.

The objectives of this thesis are to address these gaps by:

Objective 1: Establishing and assessing the actual governance framework of road freight in Central and Eastern Canada (Quebec, Ontario, Nova Scotia, and New Brunswick).

Within Objective 1 are three sub-objectives:

- *Sub-Objective 1.1:* Identifying the different actors in the road freight system in Central and Eastern Canada.

- *Sub-Objective 1.2:* Identifying how actors interact with and relate to each other in their day-to-day operations, in developing transportation policy, and in strategic planning of road freight.
- *Sub-Objective 1.3*: Assessing public understanding and knowledge of governmental action to mitigate climate change.
- *Sub-Objective 1.4*: Identifying what level of government (i.e., municipal, provincial, federal) the public believes should be responsible for select road freight decarbonization interventions.

Objective 2: Assessing the impact of different governance components on road freight. Within Objective 2 are three sub-objectives:

- *Sub-Objective 2.1:* Identifying international examples of transportation governance models and tools that may be viable in Canada's political, economic, and social context.
- *Sub-Objective 2.2:* Developing an alternative governance structure for Canada's road freight subsystem.
- *Sub-Objective 2.3:* Identifying a taxonomy of actors, roles, powers, and capacities for an alternative road freight governance subsystem.

Thesis Overview

This thesis is organized into five chapters.

Chapter 1 is a literature review that identifies the lack of overlap in research on three research streams: (a) governance, (b) land use and industrial development, (c) and decarbonization (focused on road freight). It provides an annotated bibliography of 43 sources from all three streams, identifying where there is overlap. This literature also sets the stage for the rest of the thesis by speaking to the systemic nature of climate change, providing an overview of road freight in Central and Eastern Canada, and by defining key teams (infrastructure, land use, governance, and decarbonization).

Chapter 2 is qualitative study of the perceptions of government staff involved in the governance of road freight in Ontario, Quebec, Nova Scotia, and New Brunswick. In analyzing and discussing the findings of semi-structured interviews with 11 professional

engineers and urban planners, this chapter contributes to establishing the baseline conditions of road freight governance. The discussion focuses on the tools and policy mechanisms used by professionals, how public agencies collaborate (or fail to collaborate) with each other, how the general public is engaged on matters related to road freight, and what improvements may be to the current governance of road freight. Our findings suggest that public sector staff want to better collaborate in governing road freight, but that the subsystem is currently decoupled from decarbonization, and that there are insufficient tools and organizational structures in place to achieve their goals. Chapter 2 addresses *Sub-Objective 1.1,* and *Sub-Objective 1.2.*

Chapter 3 is a study of resident perceptions of global warming, climate change, trust in government, and road freight policy interventions. It presents a cross-sectional study of Canadian opinions drawn from an online panel of participants in Ontario, Quebec, Nova Scotia, and New Brunswick. There are two distinct but interrelated analyses presented. The first analysis concerns respondent perceptions of how well their municipal, provincial, and federal governments are doing on climate change, investing in their communities, and in collaborating with each other, as well as broad questions about belief in climate change and trust in government. The second analysis explores what levels of government respondents perceive as capable to implement and lead 10 road freight policies and interventions. Our findings suggest that the public has low trust in government, and also want to see more climate action and better collaboration between all levels of government. Respondents also identified that they want to see greater provincial and federal involvement in implementing road freight decarbonization policies and interventions. Chapter 3 addresses *Sub-Objective 1.3* and *Sub-Objective 1.4*.

Chapter 4 begins with a synthesis and summary of the core findings of Chapters 2 and 3. Based on this synthesis, we outline the existing conditions of road freight governance in Central and Eastern Canada with a focus on both the role of the government actors and the residents' perceptions of their performance and perceived ideal roles. Having established the existing road freight governance system, we turn to a discussion of an alternative governance model and the tools to successfully advance road freight decarbonization. This involves working to change the narrative and profile of road freight amongst professionals and the general public, reforming the roles of municipalities, provinces, and the federal government, and implementing a toolkit for success. This toolkit involves implementing

engagement mechanisms such as freight forums, the introduction of new regional agencies focused on road freight, and new engagement frameworks such as citizens' assemblies to raise the status of residents in policy deliberation and development. Chapter 4 addresses *Sub-Objective 2.1*, *Sub-Objective 2.2*, and *Sub-Objective 2.3*.

Chapter 5 concludes this thesis with an overview of our work and a summary of recommendations that could help couple road freight and decarbonization in both the Academy and in professional practice.

A Brief Note on Scope and Terminology

Throughout the thesis, we use the terms resident and citizen interchangeability. We do not use the term 'citizen' to designate one's legal status within Canada, instead using it to denote the sense that one resides within Canada (McAllister, 2024: 9).

Similarly, we will occasionally use the terms road freight and goods movement in similar contexts. While goods movement may refer to a range of logistics and warehousing activities that are broader than road freight, it will be used from time to time as a means of ensuring readability. Unless specifically noted as denoting other types of freight (rail, marine), goods movement is referring to road freight.

We have chosen Central and Eastern Canada as the study area for this thesis, opting to not study Canada's freight subsystem as a whole. This was for three practical reasons. First, the author has extensive experience working with private sector actors and government planners and engineers in Ontario, Quebec, New Brunswick, and Nova Scotia. This comes with a familiarity of the regulatory and legislative frameworks for Central and Eastern Canada. Second, the chosen study area is generally homogenous in terms of belief in climate change. While each province has a unique relationship to narratives and concepts of decarbonization, there is an overall high level of consistency across the region that makes it an interesting area of study. Third, there are and continue to be talks about inter-provincial and regional collaboration on energy production and consumption that set a precedent to consider the region as a study area.

CHAPTER 1

LITERATURE REVIEW: LINKING UP GOVERNANCE, LAND USE AND ROAD FREIGHT DECARBONIZATION

1.1 Introduction

This literature review has two components. The first is an annotated bibliography, seen in Table 1.1 Annotated Bibliography. The annotated bibliography divides the literature into three streams: Governance, Land use and Industrial Development, and Decarbonization (Road Freight). 230 papers, books, and government/NGO reports were identified using keywords such as “road-freight”, “transportation”, “decarbonization”, “land use”, “industrial development”, “governance”, “governing”, and “transportation system”. Each paper was reviewed, and 75 sources were identified for further study. A final list of 43 sources was selected for the annotated bibliography based on their insights and lessons learned.

Table 1.1 has each source coded in light pink, blue, and green. Green sources are those that discuss or touch upon each research stream identified above. Yellow and pink sources touch on two of the research streams and one of the research streams, respectively. Of the 43 sources selected, 20.90% (9) touched on all three research streams, 41.80% (18) of sources touched on two of the streams, and 37.20% (16) on only one stream.

The second component is a thematic discussion of the three literature streams. As the junction of road freight governance, land use, and decarbonization strategies is understudied, it is valuable to consider their interconnections to identify possible directions for future research and implementation.

Table 1.1 Annotated Bibliography

	Barnett, 2020	Banister et al., 2011
Governance	✓	✓
Land use	✓	✓
Decarbonization	✓	✓
Subject Matter	Barnett analyses the United States' megaregions to understand how they may be better managed to account for climate change and future population growth. Particular attention is given to the role of transportation in balancing urban development in megaregions.	Bannister et al. provide a comprehensive overview of the ways that transportation systems impact the environment. The authors propose ideas from transition management and niche development to facilitate the more holistic design of transportation systems.
Insights / Lessons Learned	Barnett argues that transportation infrastructure has a direct, causative relationship with urban development patterns. When transportation systems are unbalanced (e.g., focus too heavily on road infrastructure at the expense of active, rail, and public transit infrastructure), the results are megaregions that have greater congestion, urban sprawl and are disconnected from one another. Barnett proposes multiple solutions that America's local, state, and federal governments may act on now to improve the growth of megaregions and to promote more environmentally thoughtful and livable development patterns. These include multi-state regulatory and development agreements, reliance on MPOs and other existing governance structures, improving the quality and content of zoning information with granular environmental and site-level mapping data, empowering states and regional bodies to make zoning decisions, and the construction of infrastructure to build out " fast enough" passenger trains.	Identifies several conceptually relevant links, such as: (1) the coupling of economic growth and transportation which may hinder attempts to decarbonize the transportation system, especially if there is a need to scale back operations, and (2) the relationship between land use and transportation. The authors provide a helpful table of policies required to decarbonize transport, their mechanisms and the time-frame for deployment. Bannister et al. identify four challenges for road freight that include: the need to limit off-shore manufacturing the carbon leakage, the need to " allocate emissions reductions equitably because a large quantity of CO_2 emissions from BRIC result from the export of goods to the OECD countries" , the need to reduce the consumption of CO_2 intensive products, and the need to introduce policies to less-developed nations policies aimed at low-CO_2 transport. The authors call for a rethinking of transportation governance: to move away from modes of thinking, policies, and instruments that have historically prioritized the car as the primary mode of travel.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Blue and Dusyk, 2022	✓		✓	Blue and Dusyk provide an overview of " how climate policy is created and approved" within Canada's federal ecosystem (1).	Blue and Dusyk paint a picture of how Canada' s federal government currently makes policy decisions concerning climate change, and explore how the government' s governance structure will change with the introduction of 1) a whole-of-government approach; 2) the introduction of the Canadian Net-Zero Emissions Accountability Act (CNZEAA); and 3) the implementation and integration of a climate lens, along with other policy tools. The authors make recommendations that aim to improve governance, government leadership, and transparency. One notable recommendation is that " the proposed climate lens [be implemented] at the level of a cabinet directive, and [that the federal government should] mandate its use for all government departments and agencies, including Crown corporation and public finance institutions such as Export Development Canada and the Canada Infrastructure Bank" (p. 11).

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Borges and Melhado, 2017	✓			Borges and Melhado use two case studies (in sanitation and transportation) to explore what interventions may improve the management of public sector infrastructure projects.	Borges and Melhado identify four " preliminary guidelines which could be recommended for the management of…infrastructure projects" : 1) identifying all relevant processes, tools and areas of interest for a project, with an understanding of how they fit into the " integrated vision of their needs and context" ; 2) the tools chosen to manage a project should be customized to meet the needs of the mandate; 3) there should be regular meetings that present the overall project, with the inclusion of all stakeholders that are responsible for decision making; and 4) professionals with expertise in project management and project specific knowledge be hired to complete the project (5).

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Brinken et al., 2022			✓	Brinken et al. focus on the potential of digitalization, and in particular, Logistic 4.0' s potential to contribute to decarbonizing supply chains. The authors use a comparative CO_2 footprint analysis.	This paper argues that Logistics 4.0' s potential to decarbonize supply chains is limited the need to involve other interventions, such as clean technologies. While Logistics 4.0 interventions into supply chain management (SCM) presented potential for up to 67% emissions reductions, for the " majority of assessed SC steps and technologies there are no or little improvements (<10%) expected" . For example, intralogistics is expected to see emissions reductions of 3% with the adoption of Logistics 4.0. The findings rightly highlight that an overemphasis on digitalization without a full policy package for decarbonization may limit the effectiveness of the former. Brinken et al. also note that the global nature of supply chains may also limit the efforts of Logistics 4.0 to decarbonize them: different emissions goals and targets, building codes, and supply chain specifics from country to country cannot necessarily be accommodated by digitalization without international coordination and cooperation.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Buck, 2018	✓	✓		Buck explores the political, social, and technical challenges associated with scaling up negative emissions technologies (NETS, i.e., carbon removal technology).	Buck argues that understanding the challenges of new climate infrastructure requires us to adopt the scale of the landscape, defined as " a place where ecological and social structures interact, larger than a farm but smaller than a region" (2). The benefits to such an approach to climate infrastructure are that it allows us to consider the particulars of the technology in question, such as: who are the workers that will be impacting the landscape? How will the deployment of " landscape-altering technologies" occur both physically in a place but also over time? And what constraints and opportunities are presented to residents who live within a given " socio-technical landscape" (2)? Buck emphasizes that there is a land use impact of any new infrastructure, and that these impacts are intertwined with who provides social license, financial support, and incentives to develop new infrastructure (and by extension, new landscapes). Buck concludes by noting that " [T]he newly politicized world of infrastructure, in combination with the lack of institutions that have a strong mandate to build out new systems, means that the institutional landscape is bleak for supporting NETs" (6).

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Buck, 2019a	✓	✓		Explores the state of the art of multiple geoengineering technologies, including carbon-capture, biofuels, and solar radiation management.	Buck identifies that much of the climate science literature overestimates the technological maturity or economic scalability of a number of geoengineering methods. Buck further notes that overemphasizing the technological considerations of climate change mitigation downplays that difficulties in deploying technology often do not have to do with what is technologically feasible, but with the economic, political, and social conditions that a technology is being deployed or tested in.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Buck, 2019b	✓	✓		In exploring the implications of new infrastructure development on meeting the climate targets set in the Paris Agreement, Buck argues that we have yet to consider the scale of new development and land use transformations needed to restore the climate.	Buck asks us to consider that an ecological and climate transition is " not just an energy transition; it is also a land use transition and a transition of the built environment…Carbon removal at the scales shown in these models implies an industrial infrastructure on the order of the existing fossil-fuel industry – facilities, injection wells, pipelines – but for putting carbon back underground. It implies a drastic shift in land use towards the reforestation of hundreds of millions of hectares: planting new forests on abandoned farmland and moving away from grazing and towards a plant-based diet that requires less land. And it implies a vast network of sensors, tracking these carbon flows and accounting for them on various platforms" (53). It is essential that visualizations of the physical manifestation of our climate transition be produced by architects, planners, and government officials to help stakeholders and citizens understand the scale of transformation needed to decarbonize buildings and other industries.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Buck, 2021	✓	✓		Buck explores the viability of net-zero targets by looking through the lens of political power, infrastructure, code, geopolitics, and culture.	Transportation is regularly categorized as a sector that is " hard-to-decarbonize" , though such a qualifier is often underdefined in the literature. It is important to clarify if we are indicating that decarbonizing road freight is socially, economically, or technologically difficult to decarbonize. Buck argues that transportation is all of the above, though the context will largely determine the manner in which the sector is hard to decarbonize. A further argument is that the overreliance by climate scientists on examining emissions from a sectoral perspective, instead of a systems lens, limits our thinking on decarbonization.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Busby et al., 2016	✓	✓		Busby et al. examine India's emissions reduction potential from a sectoral lens by looking at two axes: political and organizational feasibility and techno-economic feasibility.	Busby et al. note that there is a lack of research that explores: " what political systems facilitate rapid energy transitions, what forms of governance produce optimal energy policies, and how to reconcile climate change with energy access and energy security" . After conducting their analysis of each sector, the authors argue that the fragmentation of the market and level(s) of government involved helps to determine the viability of deploying different technologies. Even if a technology is mature/scalable, a lack of coordination and cooperation could hinder transformations in that sector.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Cruijssen et al., 2010	✓			Using data envelopment analysis (DEA), Cruijssen et al. look at cooperation and non-cooperation between trucking firms in Flanders.	This work provides insights into survey design targeted at trucking operators. The survey used a five-point Likert Scale and had respondents rate their thoughts on presented statements " on opportunities and impediments" to collaboration in their industry. Key findings included that while horizontal coordination is not easy to implement or coordinate, such integration will be necessary for the future competitiveness of the Flemish trucking sector. This paper provides a strong argument that understanding the relationships between actors can identify opportunities for better systems optimization.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Direction générale de la Politique de mobilité durable et de l' Électrification, 2019	✓	✓	✓	As part of Quebec' s Sustainable Mobility Policy (2030), the Road Freight Transportation Intervention Network highlights existing targets, as well as future actions and policies to decarbonize road freight	Demonstrates the possible governance role of road freight that the provincial government may play. Highlights the central role of road freight as a growth sector for Quebec' s economy. Serves as one of the few existing provincial policy documents aimed at decarbonizing road freight.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Doern et al., 2019	✓	✓	✓	Doern et al. provide an overview of Canada' s transportation sector by analyzing multiple " governance domains" that span road, rail, aviation, and investments into cities and public transportation.	Of particular interest, Doern et al. argue that: 1) transportation policy has often been of limited interest and priority for prime ministers over the past 50 years, which is also reflected in public opinion regarding transportation; 2) Canada' s transportation policy is intertwined with other areas of policy that include: borders, bridges, security, infrastructure, energy, technology and innovation policy, regulatory safety, amongst other policy domains; and 3) " Transportation policy in Canada is, to an ever greater extent, provincial-urban policy and governance-centered, with ongoing, more traditional federal-led nation building therefore becoming less present and noticeable" (15). Of great relevance to this research is the comparative examination of how Canada's provinces have allocated the responsibility to govern the transportation sector across different agencies (see 44–57).

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Doern et al., 2021	✓	✓		An analysis of Canada's management of infrastructure by looking at six different policy and governance regimes: Business Infrastructure, Infrastructure Financing, Transport Infrastructure, Housing infrastructure, Energy-Environment -Resources Pipelines Infrastructure, and Science, Technology, and Innovation (STI) Regime	The primary strength of this book is in its articulation of the roles and responsibilities of municipal, provincial/territorial, and federal governments, and how these roles and responsibilities have changed over time. This historicizing of the development of Canadian infrastructure opens up considerations of how the different levels of government may modify their relationships in the future. Government responsibilities have changed dramatically over time, with local ownership currently sitting at over 50% of Canadian infrastructure, while provincial and federal ownership hover around 42% and 7%, respectively. Doern et al.'s discussion of the Transport Infrastructure Regime focuses on three different histories: Rail Freight from 1990 to today, Transportation to North Communities from 1970 to today, and finally, Transit Infrastructure in Cities from the early 1990s to today. The analysis of Canada' s Transport Regime finds that " policy about transport infrastructure per se, in all its intricate detail, resides partly with government bodies that are significantly different…The clashes and mismatches between public-private infrastructure policy and the policies for the funding of infrastructure also emerge in intricate ways both regarding

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Dusyk and Turcotte, 2021	✓	✓	✓	Assessment of the state of climate action for all of Canada's provinces and territories	There is a lack of climate action on road freight and goods movement nationally despite transportation emissions accounting for 25.5% of national emissions, and road freight specifically accounting for 16% of all transportation emissions. Quebec is the only province in Central and Eastern Canada with a dedicated freight transportation plan.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Ed. Horak and Young, 2012	✓	✓		This collection of papers provides an overview of the inter-relationship between municipal, provincial, and federal government actors in managing major policy issues for major cities in each of Canada's provinces.	The collection aims to sketch out, with case studies, a series of definition(s) of multi-level governance. A multi-level governance system is a " mode of policy making [and operations] that involves complex interactions among multiple levels of government and social forces" (Horak, 2012: 339). Case studies from this collection include examples where multiple agencies attempt to cooperate and coordinate on major infrastructure, such as the ongoing development of Toronto's Waterfront (Horak, 2012), Montreal's Lachine Canal redevelopment (Bherer and Hamel, 2012), and Vancouver's light rail extensions (Hutton, 2012). As the case studies demonstrate throughout, cooperation and coordination between different actors in a multi-level governance system is desirable, but are by no means guaranteed.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Ghisolfi et al., 2022a	✓		✓	Ghisolfi et al. conducted a literature review of system dynamic models related to freight decarbonization. The 50 studies analysed were categorized by " decarbonization strategies, the external factors needed to support [decarbonization], and simulated policy instruments" .	Ghisolfi et al.' s systemic approach to decarbonization strategies highlights that " freight transport has a systemic nature, whereby changes in one element affect other elements of this system over time. A partial or disconnected view hinders a final assessment of the most effective actions." There are two additional points of interest: one is the need to pay more attention to time lags in freight transport decarbonization models, because " time is crucial for assessing whether simulated policy measures effectively achieve decarbonization targets in the short, medium, and long terms" . The second is that there are existing difficulties quantifying the relationships between actors, including " lobby practice, regulatory pressure, or market acceptance of new technologies" which call for integrated modeling that integrate all strategies, actors, and time-lag decisions.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Ghisolfi et al., 2022b	✓		✓	Building on the findings of Ghisolfi et al. (2022a), this article uses system dynamics to propose a causal loop diagram that " maps the [freight transport] system' s causal and dynamic responses to five key decarbonization strategies" .	Ghisolfi et al.' s system dynamic model consists of five subsystems that are associated with decarbonization strategies. These strategies include: 1) a reduction in demand for freight transport; 2) a modal shift to low-carbon modes; 3) improvements to vehicle utilization; 4) an increase in fleet energy efficiency; and 5) the promotion of new energy sources. Of relevance to this research are the findings that the freight transportation system is " not composed of isolated subsystems, but that they interact with each other, providing the dynamic behaviour of the whole system" . Additionally, the relationships between subsystems demonstrate that the five decarbonized strategies discussed by Ghisolfi et al. " affect each other in a reinforcing or balancing way" .

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
González Palencia et al., 2017			✓	Palencia et al. employ a stock turnover model to assess the " potential of electric-drive vehicles to reduce energy consumption and CO_2 emissions in a road freight vehicle fleet" . The model is tested with Japan as a case study.	Palencia et al. find that across all scenarios up to 2050, gasoline and diesel continue to account for 52% of energy consumed, even with " aggressive EDV deployment" , pointing to the difficulty of decarbonizing road freight, even with aggressive efforts to electrify freight vehicles. The findings of this study are based on a " silver bullet" approach whereby " 2050 new vehicle sales are dominated by a single powertrain within each vehicle size class" . This is an unrealistic assumption to make, and therefore may skew the results.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Harvey et al., 2018	✓	✓	✓	Provides a comprehensive accounting of sector-specific decarbonization policies, case studies, and technological innovations. Sectors discussed include Power, Transportation, Buildings, and Industry.	Different policy types (e.g., economic signals, research and development, performance standards, etc.) all interact with each other in different ways. The relationships between different policy types have the potential to create a vicious or virtuous circle with regards to decarbonization. The majority of Harvey et al.' s discussion of transportation focuses on passenger vehicles and medium to high density urban environments, though many of the insights concerning the development of policy are broadly applicable across sectors.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Hatuka and Ben-Joseph, 2022	✓	✓		Hatuka and Ben-Joseph develop a socio-spatial framework to explore the relationship between industrial development and urban planning.	In responding to discourses that focus on the economic and environmental impacts of economic development, Hatuka and Ben-Joseph develop a framework that desires to connect " people, places, and production" when considering industrial development in already crowded, space-limited cities. This framework, New Industrial Urbanism, sees " manufacturing as part of city life" . Such an approach may be fruitfully enjoined with Buck' s call to consider infrastructure development at the scale of the landscape. Hatuka and Ben-Joseph provide principles, multi-scalar strategies, and case studies that may be valuable in integrating manufacturing into urban environments. At its heart, this manuscript asks: " How can cities move toward a more integrated city-industry framework that unified the economic sphere, the political-social sphere, and the spatial sphere?"

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Hosny et al., 2021	✓			Hosny et al. developed a model aimed at assessing the sustainability of different infrastructure projects that considers the relevant economic, environmental, and social factors.	The benefits of Hosny et al.' s sustainability assessment model is the relative weighting of different factors and the possibility of a project proponent changing the factors to suit project objectives. Such an integrated tool allows for independent assessments of a project's economic, social, and environmental factors to be considered before being compared and weighted against each other. This is an example of a tool that may assist in decision making throughout a project's lifecycle—something that is vital to good governance.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Ivory and Trotter, 2017	✓			The stakeholders and actors involved in New Zealand's freight system after the 2016 north Canterbury earthquakes.	The development of an Actor Map based on Rasmussen's Risk Management Framework (1997) provides an opportunity to identify gaps in the existing freight system and improve network resilience.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Jonkeren et al., 2019			✓	Jonkeren et al employ a shift-share method, borrowed from regional economics, to assess the potential reduction of carbon emissions that could result from a modal shift away from freight.	The argument put forward is that modal shifts are more likely to endure if they are based on the mode's competitiveness, rather than on " that mode' s overrepresentation in above-average growing markets" . Jonkeren et al. note that this is the case because " such competitiveness will mute any possible impact from future declines of the cargo markets in which [a mode] is overrepresented" . However, the shift-share method does not elucidate *why a* method is competitive ex-post, and therefore is unable to identify which " policy interventions worked and did not work" .

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Kaack et al., 2018			✓	A literature and data review that aims to estimate the " global decarbonization potential through modal shift" of road freight.	Kaack et al. identify the need to have not only modal shifts from road freight to rail, but that such a shift must occur in conjunction and concert with " other strategies such as energy efficiency, switching to fuels with low or net zero carbon emissions, and improving operational efficiency" . The role of government should include infrastructure investment and other incentives. However, Canada' s shift to rail will be hampered by a lack of recent investment into rail infrastructure and the growing share of road freight activity relative to rail freight.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Kasteel and Ewing, 2021			✓	A summary of both technological and policy options for decarbonizing Heavy-Duty Vehicles (HDVs) in British Columbia.	There exist a number of alternative technologies for HDVs that perform better than diesel when measuring carbon emissions (e.g., BEVs, Hydrogen FCEVs, LNG, and Biofuels). However, these technologies rate worse than diesel when considering the availability of infrastructure to support deployment and equal or worse technological readiness for deployment when compared to diesel.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Kayser-Bril et al., 2021			✓	Explores the viability of adopting e-highway technology along highway corridor A20-H401, with the goal of decarbonizing long-distance road freight	This study proposes that the concept of an e-highway has some potential for use in Canada, importantly noting that " The initial infrastructure investment is often seen as a limit to large-scale deployment. But when compared with other zero-emission options, the catenary technology offers some advantages. First, it is already used in transportation (e.g., trams, trains) and second, trucks can run on either a hybrid or battery system when travelling off the electrified corridors. This flexibility combined with efficient use of electricity and mature catenary technology makes for a solid contender in the mix of potential options for decarbonizing road freight" .

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Khan et al., 2021	✓			Khan et al. study the relationship of stakeholder management on project governance and project performance for public sector infrastructure projects.	Khan et al. highlight the importance of stakeholder engagement and management for the success of public infrastructure projects (what is sometimes referred to as the social license to build or develop). Their findings on the relationship between stakeholder management, project governance, and project performance note that " Precise and responsive project governance that offers a systemic approach to administer[ing] the project progress mechanism is crucial for better public performance. The project governance in the form of operational strategy is anticipated to attain enhanced project performance in public sector infrastructure projects. It can help to avoid the common causes of project failure. To apply project governance for enhanced project performance, public sector organizations need to review their project appraisal and monitoring practices by incorporating dimensions of portfolio direction, sponsorship, effectiveness and efficiency, disclosure, and reporting to strengthen governance mechanism[s]."

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Kim 2022a	✓		✓	2022a: Recommendation to government on the adoption of policies to support the transition to zero-emission HDVs.	Kim (2022a) recommends the development of an implementation plan, the formalization of objectives for zero-emission medium and heavy-duty vehicles, and a supply- and demand-side investment strategy to transition the freight industry by 2040.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Kim, 2022b	✓		✓	2022b: Recommendations for Transport Canada for the future development of MDZEV and HDVs.	Kim (2022b) goes into greater detail on incentives for decarbonizing MDZEVs, including providing adequate timelines for truck operators to make fleet decisions well in advance, guarantee that incentives account for 50% of incremental costs and conduct multilingual outreach with fleet vendors and manufacturers both within and outside of Canada, among other recommendations.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Lawson, 2015	✓			An overview of Canada' s transportation system, with a focus on the system's policy and planning initiatives.	Provides a basic breakdown of the roles and responsibilities of municipal, provincial, and federal levels of government. Most importantly, Lawson notes that " Provincial/Territorial Governments do not produce any high-level Development Plans for economic activity. Nor do they usually produce any overall Transportation Plans."

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Levy, 2021	✓		✓	Levy proposes strategies that American federal and state governments may implement to improve the efficient, quick, affordable, and flexible development of infrastructure.	Levy observes that the United States struggles to build infrastructure in ways that other international peers do not. This is in part the result of a lack of in-house capacity of government agencies to complete infrastructure projects, as well as the result of how governmental agencies work and set up their infrastructure compacts. Other problems ailing American infrastructure development include poor procurement practices, the politicization of projects, NIMBYism, labour constraints, inadequate project management practices, and overdesign. Levy proposes several recommendations to mitigate these challenges. Of particular interest amongst these are the suggestion to improve in-house agency capacity *prior* to project kick-off and procurement, the maintenance of " up-to-date databases or maps of urban geology" by transit agencies prior to building subway systems, and " organizational curiosity" to allow agency staff to acquire expertise abroad for use in America.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Lightstone et al., 2021	✓	✓	✓	An overview of emerging trends and best practices as related to goods movement in Canada	Identifies a range of " freight-supportive strategies" at multiple scales, including: " the development and identification of arterial and secondary routes; protecting corridors and employment lands through zoning by-laws or municipal plans; and building truck bypasses and parking facilities into current road network" . Lightstone et al. go on to further note that there are a number of technological interventions currently under development that could assist with decarbonizing road freight (e.g., automation, alternative fuels). However, the lack of previous investment and the long timeframe to reach maturity or scalability may limit the ability of provinces and the federal government to meet their transportation sector climate targets.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Lorius, 2022		✓		Lorius provides an overview of the industrial development in Canada, with a focus on high-level trends.	Lorius identifies a number of emerging trends related to the development of " employment lands" . Some trends are occurring in response to the dwindling quantity of readily available industrially zoned land for development, and include: the development of " urban hybrid industrial" spaces, a greater emphasis on last mile distribution hubs, multi-story industrial buildings, and an increase in the ceiling height of new buildings. Lorius notes that " there will be a continued requirement for municipalities to provide for greenfield employment areas but the build form will respond to market requirements rather than planning policy objectives for job density" . This raises the question of *how much* planning oversight should municipalities have on the building level, given the imperative to balance economic growth with sustainable development.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Lucas et al., 2021	✓		✓	Lucas et al. present a mixed methods qualitative and quantitative approach to measuring the social impacts of transportation projects via a case study from Wales.	Lucas et al. argue that insufficient consideration is given to the social and distributional impacts of transportation projects, even when such considerations are codified as part of an impact assessment. The rationale for transportation projects is to provide growth for a region or nation, as such, social assessments are often " marginalized within [an] economically dominated transport appraisal process" . While health and social impact assessments are often conducted as part of the development process, " they...usually do not happen early enough in the decision process to successfully affect routing options or project design and so are reduced to minor mitigation and compensation measures late in the project delivery stages" . Lucas et al. recommend that social assessments should occur as part of the business casing process early in the project lifecycle and as an ongoing process through the design process, construction, and operational stages. While project proponents may perceive there to be cost and management risks to such a process, these assessments may " facilitate stakeholder ownership of projects" , resulting in community support and buy-in.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Neufeld and Massicotte, 2017	✓	✓	✓	Provides a sector-wide review of the opportunities and challenges that face Canada in decarbonizing transportation. Examines road transportation, aviation, rail, marine, and urban transportation (transit) subsystems.	Neufeld and Massicotte identify interventions available to assist in decarbonizing road transportation. These include vehicle emission standards, heavy-duty truck emission standards, alternative vehicle technologies (i.e., electric vehicles, hydrogen vehicles, natural gas vehicles, and automated and connected vehicles), and biofuels. The report highlights places where the federal government is best positioned to support decarbonization. Some of these include the promotion of vehicle emission standards, consumer information and communication strategies, support to industry programs, fuel standards and fuel regulation initiatives, and research and development. The report considers questions such as: How much should the Canadian government imitate and harmonize with American decarbonization practices? What solutions work best for rural communities attempting to decarbonize road transportation? and " [s]hould a Canada-wide strategy be flexible to accommodate different circumstances in each province and territory?" .

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Nicolaides et al., 2017			✓	Nicolaides et al. present an overview of the prospects of road freight electrification using a " logistics concept" framework.	The authors propose a division of road freight transportation into four categories and provide case studies for each: " long-haul trunking" , " urban delivery" , " home delivery" , and " auxiliary services" . The findings of the framework and resultant case studies state that " shifting towards EFVs appears to be technically and financially feasible since large and expensive on-board batteries are not required" . The reduction of carbon emissions from freight under this study will vary based on how advanced the decarbonization of the electricity grid is by 2030 and 2040.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Noussan et al., 2020	✓		✓	An overview of the transportation sector, with a focus on digitalization and decarbonization policies and technologies.	The authors strongly recommend the deployment of multi-level policies to decarbonize transportation. They identify 24 policy interventions and their respective levels of governance. However, there is no elaboration on the execution of these policies, and the discussion of technological interventions overestimates the scalability and market maturity of hydrogen and biofuels.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Öberg et al., 2016	✓			The governance of transit corridors within the European Union, with particular focus given to " governance organization" , " actors" , and " governance in practical implementation process" .	While governments are formally recognized as the primary actors in governing transport corridors, " cities, ports, regional authorities and private actors" are valuable stakeholders with underdefined responsibilities. A corridor forum that brings stakeholders together may help address multi-level challenges.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Saiyed et al., 2012	✓	✓		Saiyed et al.' s work focuses on freight management at the regional scale by discussing the development of the Peel Region Good Movement Task Force.	In the context of this work, " regional" is defined as involving multiple municipalities within the Greater Toronto Area. The discussion of Peel' s Task Force demonstrates that while the provincial government is generally responsible for roads, highways, and regulations related to vehicle specifications, it is often municipalities that end up managing inter-regional differences and movement.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Schank et al., 2008	✓	✓		Schank et al. conducted a benchmarking and best-practices survey of Metropolitan Planning Organizations (MPO) to understand how regional transportation bodies in America are currently integrating freight movement into their plans.	This study is the only one of its kind in the academic literature: it considers the governance of freight at the regional level and explores how regional governments involve local stakeholders in the planning of freight for their region. It provides a questionnaire with questions asked of public agency officials and provides a taxonomy of different initiatives related to goods movement undertaken by the different MPOs studied. One significant finding was that the inauguration of a " permanent freight stakeholder committee" that involves private, public, and citizen involvement tends to have " more active and effective freight planning" .

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Smith, 2022			✓	A discussion of the adoption of telematics systems by Canadian trucking firms.	Focuses on the benefits of private Canadian firms adopting telematics systems to simultaneously reduce emissions and meet government regulations and lowering maintenance costs.

Table 1.1 Annotated Bibliography (cont'd)

	Governance	Land use	Decarbonization	Subject Matter	Insights / Lessons Learned
Yan et al., 2021	✓		✓	Yan et al. employ a " national freight transport model" to simulate transport demand, energy consumption, and emissions. They apply the model in Ireland with scenarios running until 2050.	Four scenarios are considered: an energy price scenario, a carbon tax scenario, a diesel rebate scenario, and a fuel efficiency scenario. All four scenarios test the policy interventions independent of the others, limiting the model' s ability to anticipate " policy induced improvements in technologies and supply chain management" , as well as overlooking interactions between policy types. Yan et al. conclude by noting, " [f]reight transport demand is less elastic to policy-induced price signals, and CO_2 emissions are less likely to be reduced adequately to meet climate targets. By its nature freight movements are more heterogeneous than passenger movements. The uniqueness of freight transport should be considered when developing policy initiatives to facilitate a transition to a low-carbon freight transport sector."

The following sections will begin with a brief overview of road freight in Central and Eastern Canada, some relevant definitions, and literature stream-specific findings.

1.2 Climate Change is a Multi-Scalar Problem

Climate change is a global crisis (IPCC, 2021; Bush et al., 2022; Harvey et al., 2018). Steadily rising emissions and the elevated frequency of climate disasters are instances of processes and events that have local and regional consequences. Such processes occur within a complex planetary geophysical system that is influenced by, and influences political, social, and economic systems (Tanner and Allouche, 2011; Bridle, 2022). Climate change is a multi-scalar, multi-system problem that has different and unequal impacts across geographies, as well as differentiated impacts at local, regional, and national scales (Agyeman, 2013; Easterling, 2014; Buck, 2021; Buck, 2019b).

Climate stabilization is also a question of temporal scale: meaningful climate solutions require us to balance interventions across short-term, medium-term, and long-term horizons. With a range of both temporal and physical scales in mind, it is valuable to highlight that any attempt to address climate change must be systematic, holistic, and coordinated with the interventions of other actors. Uncoordinated and fragmented action on climate change risks setting us back from reaching the goals established by the Paris Agreement and other more ambitious local and regional targets. Buck (2021) argues that this lack of coordination and fragmentation may result in a “disenchantment scenario” where a more sustainable system sees greater investments “but has not managed the necessary planning well and can’t provide enough energy [production]” (15). We can imagine a future where investments are made into EVs and hydrogen powered goods movement and passenger vehicles, but funding for supporting infrastructure does not follow (Boin et al., 2022; Heid et al., 2022).

Across these different scales are a range of actors with different levels of responsibility and involvement working towards mitigating and reducing the impact of climate change. When considering the transportation sector, some of the actors involved include private sector firms and professional groups (Falk and Yeo, 2022; Gore, 2010; Dalby, 2019; Neufeld and Massicotte, 2017), civil-society and public interest groups (Malm, 2020; Marquis, 2012), and government regulators and political actors (Öberg et al., 2016; Ivory and Trotter, 2017; Doern et al., 2021). As such, working towards a net-zero, or more ambitiously, a negative emission (Buck, 2021, Buck, 2019a) transportation sector requires an understanding of the

relationships between different actors, their desired outcomes and interests, and the potential role they currently play and have the capacity to play in decarbonization.

1.3 A Brief Overview of Road Freight in Central and Eastern Canada

Canada's carbon emissions are dominated by two industries: oil and gas (26.2%) and transportation (25.5%). Breaking down Canada's transportation emissions further, freight accounts for 16% to 35%, and approximately 10% of Canada's overall CO_2 emissions (Dusyk et al, 2021; Smith, 2022). There is a strong environmental and social imperative to decarbonize road freight in Canada, reflected by varying provincial and federal commitments to reach a net-zero economy within the next 40 years. Despite this, Canada continues to develop its road network while under-developing rail freight infrastructure (Kaack et al., 2018).

Central and Atlantic Canada houses two of three major national trade corridors: the Ontario-Quebec Corridor, and the Atlantic Corridor (Lightstone et al., 2021; Lawson, 2015). The responsibilities for the management of the infrastructure within these corridors is shared between federal, provincial, and municipal levels of government (Lawson, 2015; Lightstone et al., 2021; Dusyk et al., 2021; Neufeld and Massicotte, 2017). The responsibilities vary for each level, but may generally be broken down as such:

- The federal government is responsible for "interprovincial and international networks of rail, air, and marine transport", the regulation of trucking companies, and other transport carriers, and safety and emissions standards for vehicles (Lawson, 2015: 2).
- Provincial governments are responsible for highways, the licensing of vehicles, and regulating transport carriers involved in interprovincial trips.
- Municipal governments are responsible for local roads, transit systems, zoning, and land use regulations.

It is important to note that in this multi-level transportation system, the roles, responsibilities, and relationships between actors tend to change over time. For example, while the federal government may not have direct involvement in local transit operations, they are often one of the largest funders of transit system projects, and therefore are able to influence local decisions through funding (Doern et al., 2019; Doern et al., 2021). This degree of funding is

not static, however, and tends to change as new governments with different priorities ascend to power.

It is valuable to ask: who plans the road freight system in Canada? Dusyk et al. (2021) and Lawson (2015) both point to the lack of clarity of the primary actor in the system. While each level of government has distinct roles and responsibilities (Neufeld and Massicotte, 2017), Transport Canada only recently released their most up to date nation-wide transportation plan at the end of 2022 (see their *Canada's Action Plan for Clean On-Road Transportation*). This is in stark contrast to both American (Schank et al., 2008) and European freight systems (Öberg et al., 2016; Cruijssen et al., 2010; Yan et al., 2021) that see more coordinated regional development and transportation plans for freight. Dusyk et al. (2021) go on to further note that Ontario, Nova Scotia, and New Brunswick all have little to no policy in place targeting the decarbonizing of road freight or goods movement in general, despite transportation emissions being one of the major sources of CO_2 and $CO_{2\text{-eq}}$ emissions in each of these provinces. Quebec is an outlier, in as much as they have developed a Road Freight Transportation Intervention Framework (2019), though Dusyk et al.'s (2021) findings indicated that there is still limited leadership regarding road freight decarbonization at the provincial level.

This lack of a national plan and structured coordination and cooperation presents an opportunity to think about the future roles, responsibilities, and actors involved in the road freight system. With greater clarity into the systems' characteristics, it will be easier to understand what policies and technologies will be best suited to decarbonize road freight in Central and Eastern Canada. The region is already primed for such interventions, as demonstrated in the existing relationships and cooperation regarding energy production and distribution (see Bouchet and Pineau, 2022 for a discussion of inter-provincial energy networks; see National Resource Canada and Nova Scotia Department of Intergovernmental Affairs, 2022 for Atlantic Canada's roadmap for green energy production).

Jurisdictional responsibilities are allocated by category in the Constitutional Act, 1867. These categories of responsibility, also known as heads of power, identify whether the legislative power over a particular system lies with the provincial government, federal government, or both. According to section 91 and 92 of the Constitutional Act, 1867, transportation is divided between the federal and provincial governments. Transport Canada (2020) notes that, "the federal government has the constitutional authority to oversee international and inter-

provincial transportation, while the provincial governments are responsible for intra-provincial transportation". As municipalities are not considered by the Constitutional Act of 1867, their powers come from a delegation of responsibilities from the federal and provincial governments, severely limiting their autonomy.

It's important to note that the division of responsibilities is more complex and fragmented than what is noted by Transport Canada's federal-provincial split (Lawson, 2015; Lightstone et al., 2021). For one, municipalities are delegated responsibilities that can include management of local roads, transit systems, and zoning and land use regulations. Provincial governments are generally responsible for managing intra-provincial journeys, highway management, and vehicle licensing. The federal government regulates emissions, safety standards, and trucking companies and operators. Municipalities are significant players in Canada's transportation system though they possess few formal constitutional powers. Municipalities are afforded powers via delegation, as is the case for transit systems and highway management. Similar powers may also be delegated to regional government agencies or bodies. Such an approach allows for effective localized management of infrastructure, though significant funding comes from provincial and federal governments. Though municipalities are provided with a degree of autonomy within this context, a reliance on provincial and federal funding means that senior levels of government may exert de facto control over transportation projects.

1.4 Infrastructure, Land use, Governance, Decarbonization: Defining Key Terms

The purpose of this section is to provide definitions for the following terms: infrastructure, land use, governance, and decarbonization.

Infrastructure should be understood to cover "public and private assets and their life cycles" (Doern et al., 2021, 4). While such a definition is rather broad, it allows for the inclusion of multi-sectoral assets such as buildings, municipal assets (e.g., wastewater infrastructure), regional or "metropolitan" assets (public facilities used by multiple cities), mega-projects (such as energy infrastructure, industrial parks, and public transit systems), and supply chains (e.g., road freight logistics, informational technology systems, etc.). Industrial development should be understood to encompass the development of assets currently required to sustain and grow road freight throughout Canada. This may include local development such as warehouses, which is primarily the responsibility of municipalities (Lorius, 2022; Doern et al., 2021), and regional and inter-provincial infrastructure, such as rail lines and highways, which

have shared responsibilities between provincial governments and the federal government (Doern et al., 2021; Lawson 2015).

Land use may be simply stated to be the purpose and uses that a designated piece of land is given for human means. Robinson et al. (2013: 7–8) note that land use is

> defined by human activity and derives its meaning from human action and valuation of land…land use can be described either using discrete states of use (e.g., agriculture, human settlements) or degrees of use (e.g., high-, medium-, or low-density residential)…Understanding land use usually requires some understanding or information about the institutional arrangements affecting users of land, such as land tenure…and what practices are permitted (e.g., zoning and set asides).

Land use encompasses zoning, or the regulatory system(s) that determine what is and is not permissible on a given plot of land. Zoning is generally the responsibility of municipalities, though depending on the size of a municipality, such responsibilities may be jointly shared by many smaller locales in the form of a "regional" organization (see for example, New Brunswick's Commission de services régionaux Péninsule acadienne which provides planning services to multiple smaller villages and towns throughout the region) (Barnett, 2020). Zoning by-laws are often determined by planning documents that include a "living" zoning by-law, a long-term master plan, and other strategy documents that a municipality decides to develop and enforce (e.g., climate plans, housing strategies, etc.).

Governance is a term that sees definitions vary across academic literatures and scales (UNECLAC, 2018). Generally, when we speak about the governance of a sector or an institution, we are referring to who is making decisions on, collaborating with other actors, and responsible for the direction of operations, and how are they governing, collaborating, and managing their responsibilities (see UNELAC, 2018:12 for a discussion of the "how" and "what" of governance).

When considering the transportation system in particular, Bannister et al. (2011, 257–258) highlight that governance "is seen as the outcome of interactions between multiple stakeholders–public authorities, industry, research institutions, the public, and others–and is a crucial aspect of the sociotechnical regime, namely the practices, cognitive routines, competences, and materialities that pattern and continually reproduce the [transportation] system". In other words, governance covers how different actors interact with, and behave

amongst each other, in a fashion that produces, and then reproduces, a system. Understanding these interactions can provide insights into how system changes may help or hinder the day-to-day operations of said system.

Decarbonization is intimately linked to net-zero (Buck, 2021; Buck, 2019a). Decarbonization implies the reduction of CO_2 emissions across the economy, and often refers to multiple scales that may include (Harvey et al., 2018; Rissman et al., 2020):

- Cross-sectoral efforts to decarbonize technologies and infrastructure related to material production. This includes the decarbonization of steel, concrete, oil, fuels, and alternative fuels.

- Sectoral emissions reductions, including in energy production, transportation, buildings, and industrial operations.

- National and multinational efforts to decarbonize economic sectors and regions. This is undertaken by focusing on policy and legal decisions that may regulate the uses and operations of technologies or sectors, such as those discussed above.

When nations speak about decarbonizing their economies, they are doing so within the context of local, national, and international climate targets. This is where the importance of net-zero comes in. Net-zero implies the ability to produce the infrastructure to remove or "sink" the same amount of or more carbon than what a nation produces. As such, it is a question of balancing CO_2 emissions production and CO_2 emissions reduction. As Buck (2021, 33–34) notes,

> Net zero, at its best, is the dream of a world in balance. Different nations have different capacities for how much they can decarbonize and how much carbon they will be able to remove. Not every nation can build an industrial carbon removal infrastructure, access hydropower, or plant carbon-sucking forests…The capacity to decarbonize is also unequal when it comes to sectors. For years, analysts have been breaking down decarbonization puzzle into pieces, looking at the capacity to decarbonize each sector.

This sectoral approach tends to focus on technological solutions, while overlooking the viability of economic and social changes that accompany decarbonization (Buck, 2021: 34). As such, system transformation is subsumed by a focus on different sectors or "wedges" that

can be decarbonized. There are two challenges to address with this. First, sectors such as transportation cut across multiple levels of government, multiple technological and policy interventions, and across national and international borders. A narrow focus on sectoral decarbonization strategies runs the risk of ignoring how these scales and their respective actors interact in ways that hinder or facilitate emissions reductions (Seattle et al., 2021). Second, the focus on technological interventions ignores that different actors will eventually have different responsibilities to decarbonize the transportation system depending on their placement within the system. For example, government actors and private actors will both have a part to play, though this part will vary based on their level of power, the working legislative framework, and the social conditions that produce the transportation system.

1.5 Governance: An Under-Utilized Framing Concept

As discussed above, there is a lack of provincial and federal strategies targeting the road freight transportation system. The lack of a system wide approach to freight that incorporates social, technical, and political-economic considerations hampers both provincial and federal decarbonization targets and undermines private market actions aimed at climate repair (Buck, 2019a; Buck, 2021). In general, the scope of the literature on governance and transportation tends to focus on municipal matters, such as curbside management and urban freight (Maxner et al., 2022; Machado-León et al., 2020; Diana et al., 2020; Urban Freight Lab, 2020; Urban Freight Lab, 2022; Aifandopoulou and Xenou, 2019; Wygonik et al., 2016; Guerrero and Proulac, 2014; Young et al., 2022). The lack of academic and institutional focus on road freight has to do with the scale of the sector: municipal governments are responsible for a small (but significant) segment of road freight infrastructure (Doern et al., 2021) but have little influence over the regional and national components of the system (e.g., logistics and supply chains, provincial and federal roads, etc.). As such, it follows that the literature would limit their focus to what municipalities can control: limiting congestion and emissions resulting from freight deliveries within cities (Brazeau et al., 2021).

In instances where governance is considered for road freight, the roles and responsibilities of actors are stated without explanation. The clearest example of this is Noussan et al.'s (2020: 100–101) table of "Transport Policies and Governance Levels". The table highlights policy interventions by transport type (Passenger Transport and Freight Transport) and governance level (City, Country, and International), but does not explain how the governance of such

policies is to take place. For example, they note that the regulation of trucks should happen at the national level but do not explore the complexities of such regulation. In Canada, for example, such regulation happens at the provincial and municipal level (Lawson, 2015; Lightstone et al., 2021). While both a truck license and a driver's license are provincially regulated, some municipalities have programs to permit trucks to operate in their municipal limits, such as Vancouver's Commercial Vehicle Decal Program. This program replaces the normal provincial truck license. Other authors that discuss ill-defined governance include Öberg et al. (2016) and Ivory and Trotter (2017).

Thinking through the lens of governance, we need to ask not only who is responsible for the different parts of the road freight system, but the effectiveness of their governance in relation to other actors. There is a need to clarify, for example, how municipal governments should interact with the province and federal government in managing the different components of the road freight system, as well as whether the current roles and responsibilities of municipalities match their given legal powers. These same concerns may also apply to provincial and federal governments.

A governance focus on road freight decarbonization allows us to understand the dynamics of the transportation sector. It also allows us to identify the best-placed actors within the system and assign them responsibilities which will maximize any benefits from policy and technological interventions.

1.6 Land Use and Industrial Development

Much of the literature surrounding decarbonization mentions land use as an afterthought. As such, the development of warehouses and other freight transportation system infrastructure (and its supporting regulatory framework) is understudied in the literature. However, the success of many of the existing and proposed technological innovations for road freight will require enormous tracts of viable land and complex buildings to support the technology. For example, biofuels (both simple and advanced) have low energy densities and will require large tracts of land to cultivate for use in trucks (Noussan et al., 2020; Jelley, 2020; Buck, 2018). Low energy density renewable energies, such as wind and solar farms, face a similar problem: large swathes of land are required to produce comparable amounts of energy to fossil fuel plants (Jelley, 2020; Buck, 2019a; Buck, 2019b; Gross, 2020; Hughes, 2021).

The transformation of the landscape is a social and political challenge with technological dimensions (Buck, 2019a; Buck, 2021; Hughes, 2021). The support for green infrastructure requires social acceptability and political will to succeed (Gross, 2020; Hughes, 2021; Battaille et al., 2020; Wotzel, 2020; Tanner and Allouche, 2011). Warehouses and logistics facilities do not receive the same level of public scrutiny as wind farms, but their impact on the visual field of many Canadians is still apparent (Hatuka and Ben-Joseph, 2022). Some cities, such as Cambridge, Ontario, have even started to reconsider the value of unfettered industrial growth, especially in primarily agricultural and rural areas.

What does this mean for the research at hand? When a shipment must move across the country or a particular region of Canada, it is generally moving from one warehouse to another. While road freight has been growing steadily since before COVID-19, the pandemic saw the explosion of e-commerce and logistics (Lorius, 2022; Young et al., 2022; Harvey et al., 2018). This has resulted in steady growth and construction of industrial facilities to accommodate the demand for road freight. The placement of these warehouses is decided by private firms within the limitations set by municipal government land use and zoning regulations. The lack of coordination between municipalities and other levels of government permits the private sector to determine the most acceptable area for operations, regardless of potential environmental and social impacts. If a by-law already permits industrial uses, there is little to be done to prevent the location of a warehouse on that lot. The pace of industrial development tends to move faster than that of municipal by-law redevelopment, and there is regular disagreement between developers and municipalities regarding the pace of the development process (Ben-Joseph, 2005; Hatuka and Ben-Joseph, 2022). As such, the lack of a structured means of considering road freight infrastructure may result in poor (but legal) placement of facilities. Moreover, just as carbon leakage is a concern at the national and international level, municipalities with by-laws prohibiting some industrial uses (e.g., trucking or logistics) may still be affected by these industrial uses. As by-laws tend to be specific to each municipality, town or village, private actors may decide to locate their warehouses in neighbouring locales, rather than canceling a project.

The development of freight plans that involve municipalities, regional administrative bodies, and the provincial and federal government may provide one pathway that results in better coordination or clustering of industrial uses. This could lead to better environmental outcomes, and fewer negative externalities for local citizens. Municipalities may also consider

coordinating with their neighbours to develop regional industrial growth plans, or goods movement strategies to manage the growth of road freight dependent industrial development (Schank et al., 2008).

1.7 Decarbonizing Road Freight Transportation

Targets that aim for a net-zero economy provide some leeway for “hard-to-decarbonize” industries to continue emitting to allow for minimal economic and social disruptions (Buck, 2021). As there are varying horizons for technologies to scale-up and become economically competitive, it is expected that some industries will continue to emit well past 2050. There is an understanding in discussing net-zero goals that gains in some sectors will permit for slower emission reduction trajectories in others. Transportation is considered a “hard-to-decarbonize” sector, in part because of the interrelationship between economic growth and demand for transportation infrastructure (Bannister et al, 2011; Noussan et al., 2020; Ghisolfi et al., 2022a). Other “hard-to-decarbonize” industries where leeway is often provided include the production of electricity, the construction of buildings, and the extraction and production of industrial materials (Harvey et al., 2018; Buck, 2021).

Before discussing the literature on road freight decarbonization, it is valuable to look at the broader landscape of “hard-to-decarbonize” industries in Canada. The bulk of Canada’s emissions come from hard to decarbonize industries, including buildings (12%), oil and gas (23%), electricity (11%), transportation (24%), and emissions-intensive and trade exposed (EITE) industries (Dalby, 2019). It is projected that Canada’s emissions from oil and gas, and EITE industries will increase by 2030 by approximately 10.4% and 11.8%, respectively, while emissions from electricity generation will decrease by 36% (Galvez and Macdonald, 2018: 16). With these changes, it is still expected that Canada will be emitting approximately 199 MT CO2-eq over the set emissions target of 722 MT CO2-eq (Galvez and Macdonald, 2018: 16).

Emissions are not evenly distributed across Canada. For example, the bulk of EITE emissions are concentrated in Ontario, Quebec, Alberta, and Saskatchewan, while petroleum refining is concentrated in Ontario, Alberta, New Brunswick, and Quebec (Galvez and Macdonald, 2018: 23). Given that much of Canada’s emissions are related to products and materials that are traded globally and subject of international markets, regulations that impact EITE run the risk of making Canadian industries uncompetitive globally, resulting in potential carbon leakage

as supply chains shift to other markets with lower prices and fewer environmental regulations (Harvey et al, 2018; and Galvez and MacDonald, 2018). As such, disruptions to the economic viability of EITE and petroleum industries run the risk of harming over 1 million jobs (Galvez and MacDonald, 2018, 9). A lack of action poses other risks: indigenous communities and those that rely heavily on resource extraction and industries that have large emissions are disproportionately affected by the negative health and environmental externalities of heavy industry (Onifade, 2022; Agyeman, 2013; Kuddus et al., 2020; and Galvez and MacDonald, 2018).

Canadian industry leaders have noted that a central challenge to decarbonizing heavy industry is that most of their emissions come from fixed-process emissions, which are “caused by the combustion of fuels as well as the non-combustion of chemical and physical reactions” (Galvez and MacDonald, 2018, 21). Tackling these emissions will require intensifying government investments into research and development to hopefully produce technological breakthroughs. Greater subsidies and market signals are required to indicate to stakeholders that there is support for finding ways to limit fixed-process emissions. Some of the innovations that are in development may be costly, cause other environmental concerns, or are not currently scalable/commercially viable.

Much of the literature on the decarbonization of road freight is concerned with modeling the potential for emissions reductions (Kaack et al., 2018; Jonkeren et al., 2019; Nicolaides et al., 2018; González Palencia et al., 2017; Brinken et al., 2022; Charabi et al., 2020) or simulating a range of scenarios with different policies implemented (Yan et al., 2021; Ghisolfi et al., 2022a; Ghisolfi et al., 2022b). Another stream examines the viability of different technologies in different national or sub-national jurisdictions (Kasteel and Ewing, 2021; Kim, 2022a; Kim, 2022b; Smith, 2022; Kayser-Bril et al., 2021).

This modeling work provides valuable insights into the potential outcomes of new technologies and their speculated deployments up to 2050. However, the focus of the literature on “metrification, accounting, and modeling” tends to overestimate the maturity of technologies or their potential to decarbonize road freight. For example, González Palencia et al. (2017, 2940) found that even in scenarios with “aggressive EDV [electric-drive vehicles] deployment” gasoline and diesel will still represent 52% of all energy consumed by road freight. Moreover, their modeling is premised on a “silver bullet” approach where electric vehicles dominate each

vehicle size class by 2050. Harvey et al. (2018) have argued that there are no silver bullet solutions to decarbonization—instead, a mixture of policies and technologies need to be deployed in conjunction with each other. As such, such modeling provides an insufficient baseline for determining the viability of EDV deployment. Brinken et al. (2022) provide another example of the overpromising that occurs in discussing decarbonization technology. Their study of the potential emissions reductions from the roll-out of Logistics 4.0 for freight supply chains found that for the "majority of assessed SC [Supply Chain] steps and technologies there are no or little improvements (<10%) expected". (Brinken et al., 2022: 469) As our timeline to decarbonize shortens, it is imperative that we have clarity about where to invest both time and money into the infrastructure and policies most likely to provide the greatest reductions in emissions.

Buck (2021, 54) asks us to consider that "what's feasible is conditioned by assumptions about several things, including (a) markets, (b) the role of the public and public power, (c) technical change, and (d) what governments can to do [sic] support change". While modeling the decarbonization of road freight, it is important to not just focus on the technical changes, but on the whole system in which such changes will occur. Ghisolfi et al. (2022a, 24) advocate for this outlook by noting that "freight transport has a systemic nature, whereby changes in one element affect other elements of this system over time. A partial or disconnected view hinders a final assessment of the most effective actions."

In returning to the idea of "hard-to-decarbonize", we want to highlight that it is important to specify whether a sector is challenging to decarbonize for socio-political, economic, or technical reasons. Transportation may be an instance of all three. It is socio-politically challenging as it involves multiple public and private actors and employs many Canadians. It is economically challenging because of the coupling of transportation and economic growth, meaning that the wrong mix of policies has the potential to disrupt not only employment, but also the growth of the economy. It is technically challenging because we have yet to reach market maturity for several alternative solutions, such as hydrogen batteries, electric fuel cell batteries, or more robust rail-freight networks. There is no silver bullet solution to decarbonizing road freight. The task ahead requires us to think carefully and deeply about how we govern our systems and who should oversee their operations and management.

CHAPTER 2

GOVERNING ROAD FREIGHT IN EASTERN AND CENTRAL CANADA: PUBLIC SECTOR PERCEPTIONS OF GOODS MOVEMENT DECARBONIZATION

2.1 Introduction

This chapter aims to contribute to research on road freight, decarbonization, and governance by exploring how public-sector staff perceive and construe their relationships with other levels of government. Through semi-structured interviews with public sector planners and engineers who work on road freight in Central and Eastern Canada, this chapter analyses the existing degree of cooperation between Canadian government actors, what barriers hinder effective regional cooperation, opportunities for better working relationships, and the kit of tools and strategies that can lead to the better management of road freight and decarbonization throughout Central and Eastern Canada. Focusing on road freight decarbonization in Ontario, Quebec, New Brunswick, and Nova Scotia provides an opportunity to study a discrete but diverse part of Canada that has parallel opportunities for greater energy system integration (Bouchet and Pineau, 2022; National Resource Canada and Nova Scotia Department of Intergovernmental Affairs, 2022). Road freight intersects with a range of complementary areas of study, including land use and zoning, land economics, economic development, regional transportation planning, and road engineering and design. As such, it is governed by a multi-level governance system that implicates multiple public sector actors, the private sector, and civil society in its management.

In this chapter, we begin by describing the state of existing literature on road freight decarbonization, focusing on approaching transportation from a systems lens and exploring how Canada's multi-level governance of road freight shapes and impacts the behaviour of the public sector. We then outline the findings of our interviews with public sector planners and engineers, focusing on the challenges and opportunities presented for smooth collaboration and cooperation between different levels of government.

Recognizing that the public sector acts in a resource and capacity constrained environment, we then discuss how government staff may strengthen their efforts to decarbonize road freight

by focusing on a) optimizing the use of their existing tools, strategies and infrastructure, b) considering transformations to the allocation of responsibilities between levels of government, and c) advancing more explicit efforts to couple road freight and decarbonization. We conclude by exploring future avenues of study on the governance of road freight in Canada. While this chapter focuses on road freight, many of its findings may also resonate with practitioners and academics who work on public transit and other regional multi-level governance systems.

This chapter addresses Sub-Objectives 1.1 (Identifying the different actors in the road freight system in Central and Eastern Canada) and Sub-Objective 1.2 (Identifying how actors interact with and relate to each other in their day-to-day operations, in developing transportation policy, and in strategic planning of road freight).

2.2 Background

2.2.1 Road Freight in Canada

The governance of road freight is an under-studied component of the transportation system, both in Canada and abroad (Hall and Hesse, 2013). Existing literature on the decarbonization of road freight has focused on technical studies covering the potential for trucking emissions reduction (Kaack et al., 2018; Jonkeren et al., 2019; Nicolaides et al., 2018; González Palencia et al., 2017; Brinken et al., 2022, Charabi et al., 2020), simulations of the implementation of different policies (Yan et al., 2021; Ghisolfi et al., 2022a; Ghisolfi et al., 2022b), and the viability of different technologies in national or sub-national jurisdictions (Kasteel and Ewing, 2021; Kim, 2022a; Kim, 2022b; Smith, 2022; Kayser-Bril et al., 2021; Heid et al., 2022). The literature on Canada's road freight system primarily focuses on the causes and consequences of logistics sprawl (Woudsma et al., 2015; Aljohani and Thompson, 2016; Woudsma and Jakubicek, 2020) or municipal planning and employment lands (Lorius, 2022; Aderneck, 2023). Less attention has been given in the literature to the governance of road freight in Canada or abroad (see Woudsma, 2013; Kim et al., 2023; Schank et al., 2008; and Akgün et al., 2019 for notable exceptions) let alone its overlap with decarbonization efforts. In a country that has multiple levels of government that manage the overlapping components of the transportation system, a poor understanding of road freight governance risks hindering Canada's decarbonization efforts (Dusyk et al., 2021; Kim et al., 2023).

Road freight and warehousing account for 3.6% of Canada's GDP while employing 5.2% of Canada's workforce (Fan and Heminthavong, 2022), acting as a critical sector for "economic growth and trade in municipalities and across the broader economy" (Kim et al., 2023: 16). Canada's road freight transportation system encompasses three inter-provincial and national trade corridors, and approximately 1.13 million lane-kilometers of two-lane public roads (Lightstone et al., 2021; Lawson, 2015). Central and Atlantic Canada houses two of these major corridors: the Ontario-Quebec Corridor and the Atlantic Corridor (Lightstone et al., 2021; Lawson, 2015). As the movement of goods and related industrial development sees sustained growth, it is expected that demand for transportation infrastructure will continue to increase over time (Ghisolfi et al., 2022a). Road freight accounts for 36.7% of GhG emissions from Canada's transportation sector, a number that is larger than the emissions of "rail, aviation and marine freight combined" (Fan and Heminthavong, 2022). Road freight sector emissions continue to climb, in spite of an overall decline in emissions "by 8.4 percent from 2005 levels, spurred on by strong demand for logistics and warehouse facilities" (Dusyk et al., 2021: 4).

Goods movement does not occur in a vacuum, nor do its patterns and trends adhere to geographic boundaries. Goods movement in Canada is strongly influenced by both American regulations and practices, as well as the practices of international supply chains and logistics. Moreover, it is important to acknowledge road freight occurs within the context of capitalist markets that both shapes, and responds to consumer demands (Agyeman, 2013, Buck, 2021) and a change in consumption patterns to favor faster deliveries of goods. The increased demand for logistics facilities is consistent with trends seen in the United States (Calma, 2022a; Calma, 2022b). Calma (2022a) notes that in profiling California's Inland Empire that "the rise of online shopping has triggered a dramatic change in the landscape here and across the country – every $1 billion [USD] in online sales drums up demand for 1.25 million square feet [28.69 acres] of warehouse space" with up to 95.82 kilometers of land allocated to logistics uses alone. Cities such as Montreal, Toronto, and Vancouver have all seen significant increases in demand for logistics facilities that are consistent with the demand for space seen in the United States, especially in the wake of COVID-19.

The regulatory framework for goods movement is influenced by larger neoliberal policy efforts to "maximise value in the public sector" by adopting private sector strategies (Mazzucato & Ryan-Collins, 2021: 348). This approach, known as New Public Management (NPM), seeks to treat public sector agencies as if they were private businesses. The rationale behind NPM

is that treating public sector operations and competencies like a business will result in greater accountability for residents, in a way that is analogous to the accountability firms and their boards have to shareholders. The policy outcome of NPM is that critical transportation services have been privatized, including aviation and rail freight, both in Canada and internationally (Mazzucato & Collington, 2023; see Doern et al., 2021 for a history of Canada's infrastructure regimes and privatization). This has resulted in a socio-political environment where road freight is governed by private actors who are regulated by a constrained public sector. This socio-political environment will be discussed in greater detail in this Chapter, as well as in Chapters 3 and 4.

2.2.2 Approaching Road Freight Decarbonization from a Systems-Lens

Climate action on transportation in Canada is currently characterized by a lack of sufficient funding, limited regional coordination between different levels of government, and the absence of provincial or federal plans that provide targeted interventions to decarbonize the system (Dusyk et al., 2021; Kaack et al., 2018; Onifade, 2022; Dalby, 2019). There is a lack of policy that integrates social, economic, technical, and political facets into a single approach to transportation decarbonization. Uncoordinated and fragmented action on climate change risks setting us back from reaching the goals established by the Paris Agreement and other more ambitious local and regional targets in Canada. Buck (2021) characterizes this lack of coordination and fragmentation as leading us towards a "disenchantment scenario" wherein a more sustainable system has seen sizable investments "but has not managed the necessary planning well and can't provide enough energy [production]" (15). It is not difficult to imagine a system where investments are made into electric or hydrogen vehicles for passengers and goods movement, but comparable investments fail to materialize for supportive infrastructure such as charging stations (Boin et al., 2022; Heid et al., 2022).

Part of the challenge at hand is a question of approach. Existing literature on decarbonization pathways tends to focus on the technical pathways to decarbonize different sectors, such as transportation, industrial operations, and electricity (Rissman et al., 2020; Harvey et al., 2018, Buck, 2021). Such literature emphasizes sector-by-sector approaches to decarbonization. However, there are often interdependencies between sectors that limit the efficacy of a sector approach to decarbonization. The interconnection and interdependency between energy systems and transportation systems is one example. There is a need for a multi-system, multi-

scalar, socio-technical approach to decarbonization (Buck, 2021; Buck, 2019; Agyeman, 2013). For example, the electrification of medium- and heavy-duty vehicles is not simply a question of new fleets, but also of supportive grid infrastructure and capacity and collaborative agreements between different levels of government and the private sector. Limiting our thinking of decarbonization to a sector-by-sector basis constrains the depth of our thinking.

Instead, we should reframe how we speak of decarbonization and road freight transportation to focus on Canada's transportation system and sub-systems. Ghisolfi et al. (2022b: 3) demonstrate the value of a systems approach in their study on how "several strategies interact and are considered simultaneously" to understand the interdependencies between freight decarbonization interventions. Elsewhere, Ghisolfi et al. (2022a: 24) argue that impacts on different parts of the freight system "affect other elements of this system over time", requiring both a birds-eye and granular view of such a system to understand the interdependencies and interrelationships involved.

With this in mind it is instructive to provide a brief systems framing of Canada's transportation system in order to understand how different actors may most efficiently and effectively act and interact to meet present- and future-set climate targets. There are two axes of the transportation system to consider. First, there are modal sub-systems, including aviation, road, rail, and marine transportation sub-systems (Doern et al. 2019; Transport Canada, 2022). Second, there are regional and scalar sub-systems, including land use and municipal land management, real estate development, social, and political sub-systems. The interactions between these different systems are many-to-many with policies and transformations within each sub-system impacting others. For example, modal shifts from one sub-system (e.g., road transportation) to another (e.g., rail transportation) can impact not only system-wide emissions outputs but also land use patterns (through the siting of warehouses, municipal land use by-laws, etc.). Changes to sub-systems may also impact real estate speculation and new developments (Ben-Joseph, 2005), and social systems through changes to behavioral patterns (Harvey et al., 2018; Rissman et al., 2020; Tortajada and González-Gómez, 2022). The complexity of Canada's transportation system arises from the interactions and interdependencies of these different sub-systems and their corresponding actors.

2.2.3 Multi-Level Governance, Cooperation, and Jurisdictional Responsibilities

Canada's fragmented response to climate change is in part a result of Canada's overall division of responsibilities across multiple jurisdictions. Jurisdictional responsibilities are allocated by category in the Constitutional Act of 1867. These categories of responsibility, also known as heads of power, identify whether the legislative power over a particular system lies with the provincial government, federal government, or both. According to section 91 and 92 of the Constitutional Act of 1867, transportation is divided between the federal and provincial governments. Transport Canada (2020) notes that, "the federal government has the constitutional authority to oversee international and inter-provincial transportation, while the provincial governments are responsible for intra-provincial transportation". As municipalities are not considered by the Constitutional Act of 1867, their powers come from a delegation and downloading of responsibilities from the federal and provincial governments, severely limiting their autonomy.

Both Lawson (2015) and Lightstone et al. (2021) highlight that the division of responsibilities is a little more fragmented than noted by Transport Canada's division between the federal and provincial government. For example, the federal government regulates trucking companies and other transportation vendors, emissions and safety standards for vehicles, and the movement of dangerous goods. Provincial governments are generally responsible for the licensing of vehicles, the management and regulation of intra-provincial trips, and the management of highways, while municipal governments oversee local roads, transit systems, and zoning and land use regulations. However, in the case of transit systems and highways, powers are sometimes delegated to municipal or regional agencies to ensure effective and localized management, though funding comes from the provincial and federal government. This means that while cities are provided some autonomy, the importance of higher-level funding to cities results in both provincial and federal governments exerting control over the development and ongoing management of transportation. As Doern et al. (2021, 71) note: "though the federal government is given no formal powers over local government, almost everything it does and spends has a direct or indirect impact on municipalities, and on larger cities in particular". Some such examples include the ongoing development of Toronto's Waterfront (Horak, 2012), Montreal's Lachine-Canal redevelopment (Bherer and Hamel, 2012), and Vancouver's many light rail extensions (Hutton, 2012).

In this context, it is important to briefly note that the 20th and 21st centuries have seen a steady shift from government action to governance, as well as a softening of the boundaries between private and public sector responsibilities (Emerson and Nabatchi, 2015; Easterling, 2014; Mazzucato and Collington, 2023). This shift has been marked by a transition away from top-down government planning towards a more polycentric, distributed, and fragmented approach to policy making and problem solving (Young, 2012: 6; Easterling, 2014). In the case of the transportation system, there is a multi-level governance system, which can be understood as a "mode of policy making [and operations] that involves complex interactions among multiple levels of government and social forces" (Horak, 2012: 339). Not only is there the presence of multiple governmental agencies, but also private market actors that attempt to coordinate to "ensure safety, efficiency, environmental sustainability, and security" (Transport Canada, 2020). Some of the key actors involved in the transportation sector include professional groups and private firms (Falck and Yeo, 2022; Gore, 2010; Dalby, 2019; Neufeld and Massicotte, 2017; Mazzucato and Collington, 2023), civil-society and public interest groups (Malm, 2020; Marquis, 2012), and government agencies, regulators, and political actors (Öberg et al., 2016; Ivory and Trotter, 2017; Doern et al., 2021).

Cooperation and coordination are not givens, regardless of whether we are speaking of different levels of government, social interest groups, or private market actors. While multi-level governance involves complex webs of relationships within a sub-system, it does not guarantee or permit us to assume that cooperation occurs or is efficiently coordinated. From one province to the next, the relationships between government, civil society and private market actors are distinct and see different configurations (Young, 2012; Horak, 2012). This is in part the result of each actor's relative power from one locale to the next, as well as the structure of the economy. While Canada's federal system provides the backdrop for all relationships between provinces and other actors, "the role of each government varies depending upon the problem, sector of activity, and the existence of a tradition of intervention, rather than upon the constitutionality recognized prerogatives proper to each" (Bherer and Hamel, 2012: 130).

The influence and relative power of private market agents varies from one province, region, and municipality to the next. For example, in the City of Saint John, industrial interest groups have had great success in working directly with provincial government officials to secure outcomes that support industrial and economic development near the City's port (Marquis,

2012). This is in part the result of an alignment of vision between all levels of government to focus on economic development to raise the profile and prospects of Saint John (Marquis, 2012).

2.3 Methods

This research employed a qualitative approach to understanding the perceptions of public sector planners and engineers in Ontario, Quebec, New Brunswick, and Nova Scotia. A qualitative approach was chosen in order to address the lack of research exploring the perceptions of public sector employees involved in road freight. There are few qualitative studies that look at the perceptions of freight actors, let alone public-sector employees (see Bache et al., 2015; Schank et al., 2008; Ivory and Trotter, 2017; and Akgün et al., 2019 for exceptions). These interviews presented an opportunity to better understand how public sector employees perceive collaboration and cooperation with different levels of governments, and how prominent decarbonization is to their work.

Participants were recruited by disseminating notices to members of major professional associations[1] and through snowball sampling.

Interviews were semi-structured and lasted between 30 and 90 minutes. Interview questions were divided into three segments: (a) basic information on interviewee professional backgrounds and day-to-day responsibilities, (b) questions about how the interviewee collaborates and cooperates with different public-sector stakeholders and actors, and (c) open-ended questions about innovation, the role of the general public, and private sector actors in road freight, and their perceptions of general trends in transportation.

Where permitted, interviews were recorded and transcribed. In instances where interviews were not transcribed, notes were taken by the author.

Eleven public sector employees were interviewed between September 2023 and January 2024. Five respondents were located in Ontario, two in Quebec, two in Nova Scotia, and one in New Brunswick. Of the respondents, one was employed by a Federal ministry, two at a

[1] Organizations who distributed calls for interviews through their email lists or on LinkedIn include the Canadian Institute of Planners (CIP), the Ontario Professional Planners Institute (OPPI), the Ordre des urbanistes du Québec (OUQ), Licensed Professional Planners of Nova Scotia (LPPANS), Engineers Canada, the Canadian Urban Transit Association (CUTA), and the Institute of Transportation Engineers (ITE) Canada.

Crown Corporation, one at a Provincial transportation agency, five at municipalities, and two at regional planning agencies.

The staff interviewed came from a range of backgrounds and positions, including road and highway design, high-level policy development, regional and system planning, and forecasting and analytics. The diversity of these backgrounds is consistent with the range of responsibilities and tasks associated with managing road freight (Lightstone et al., 2021; Lawson, 2015).

2.4 Limitations

One limitation became apparent while recruiting respondents for interviews. Especially amongst planners and engineers working for Crown Corporations, Provincial agencies, or Federal agencies, there was a reticence to participate and provide comments on their collaboration with other levels of government. Both prospective and participating respondents perceived risks to their comments becoming public. This highlights the political and often contentious nature of transportation planning and engineering (Ampleman, 2021), especially at higher levels of government.

Similarly, there is a limitation to using self-reported data, especially for questions of collaboration between different levels of government, where actors are often ongoing partners and colleagues in the course of one’s career.

An additional limitation was the risk of self-selection bias amongst respondents. However, as discussed by Linovski (2022: 5), “it is unknown what type of planner [and engineer] would be more likely to participate in this research”. It was noted that public sector staff who did participate were passionate about their work and about the decarbonization of Canada's transportation systems.

A final challenge was getting a proportionate spread of respondents across provinces. Some of this was the result of a lack of specialization amongst planners in small regional governments and municipalities in provinces such as Nova Scotia and New Brunswick. Some respondents noted that the pool of public sector staff who work on road freight is a small

subset of planners[2] and engineers in Canada. In the course of interviews, respondents noted that they often rely on consultants to complete some of their road freight related mandates. It is important to consider that many key government responsibilities have been allocated to consultants as public sector bodies struggle with capacity (both financial and staffing), losses in institutional knowledge, and demands to be "fiscally responsible" (see Mazzucato and Collington, 2024; Levy, 2021; Kim et al., 2023).

2.5 Findings

Responsibility for road freight is distributed across governmental departments and areas of expertise

The management and governance of road freight was described across a range of activities, including economic and regional development (IN1), transportation systems planning (IN2), transportation planning (IN4, IN5, IN6, IN8, IN11), transportation engineering (IN7), modeling, forecasting and analytics (IN3), policy planning (IN9) and corporate planning (IN10).

The general scope of respondent responsibilities include:

- Broad visioning, strategic planning, and long-range planning for industrial lands and assets (IN1, IN2, IN4, IN5, IN10, IN11, IN9);
- facilitating collaborations between internal and external actors on curbside management, road freight, the right of way, and urban logistics (IN1, IN2, IN4, IN6, IN9);
- the deployment of planning analytics and modeling (IN3, IN7); and
- supply chain management (IN8, IN11).

Respondents often described themselves as playing an advisory, advocacy or support role while trying to direct private sector actions (IN1, IN2, IN4, IN6, IN10, IN11). For instance, there

[2] It is valuable to consider that as of 2023, there were 9,441 Registered Professional Planners (RPPs) in Canada. Of those, only 335 were located in New Brunswick, Nova Scotia, Newfoundland, or Prince Edward Island (CIP, 2023). While one is not required to have the designation of RPP to practice planning, and by extension, work as a planner with key responsibilities for road freight, the sample size of planners who would have such responsibilities is small. The number of engineers in Canada is much larger, with Engineers Canada having 319,023 members at the end of 2022 (Engineers Canada, 2022). New Brunswick has approximately 5,700 members, while Nova Scotia has 8,400 members (Engineers Canada, 2022).

was a general consensus amongst respondents that the public sector is not “doing” the key activities related to goods movement and road freight—the public sector is not developing industrial facilities, nor are they moving and delivering goods regionally. To this end, one respondent noted:

“Goods movement is a shared responsibility. It is not a responsibility of just the public sector” (IN2).

The respondent went on to further explain that they had daily interactions with private actors regarding the management of the regional freight system, and that much of this work involved attempting to balance the needs of goods movement and the movement of people through influencing land use patterns, the development of the road network, and the regional placement of logistics and warehousing facilities. Other respondents spoke to some of the considerations that define the ideal placement of road freight facilities, including a location with close proximity to highways or arterial roads, within existing industrial areas, and near a strong labour pool that can easily travel to and from work.

The most common activities undertaken to manage road freight involved the development of transportation master plans and related planning documents, such as goods movement strategies, or curbside management strategies, the creation, maintenance, and analysis of demand management models, the convening of regional partners (both public, private, and academic), and site-specific analysis of freight impacts from new developments.

A subset of respondents noted that they had little direct involvement in road freight management in their day-to-day responsibilities (IN3, IN5, IN8, IN7, IN10, IN11). Some of these respondents described their role as being an in-house resource for their organization, providing project and programmatic inputs when road freight questions came up during development applications, in regionally significant projects, and when engaging external partners (e.g., CN Rail, other municipalities, and private sector actors). Two respondents (IN10, IN11) described their role as an advocate for road freight. In an environment where internal actors have a vested interest in shaping regional goods movement, these respondents saw it as their role to advocate for better planning, in spite of not being the owners of decisions related to road freight.

Similarly, respondents spoke to the attempt to direct land use decisions with the aim of pushing for green or net-zero uses of industrial lands. Most noted, however, that they had little involvement or impact in the decarbonization of road freight. Consideration for decarbonization was seen as an important topic for respondent's organizations, while many noted that they are only indirectly involved in decarbonization initiatives, or that decarbonization and road freight are not explicitly coupled by their organization. For instance, one respondent noted that while decarbonization is not specifically dealt with by their regional government, it is central to how they approach their work, as it is a "cross-cutting [theme] in the sense that the very practice of urban planning, of land use planning, aims for the optimal use of resources in a given context" (IN5). The implication is that good planning practice should align land use decisions with the decarbonization of road freight. However, respondents stated that they are often not directly accountable for decarbonization initiatives, limiting the overlap between road freight management and "sustainable" initiatives.

Existing tools to manage road freight are limited and unstructured

The most common set of tools currently in use by respondents were policies and guidelines. For the full breakdown of tools by participant see Table 2.1 Road Freight Tools by Participant. All but one participant noted that documents such as by-laws, strategic plans and visions, transportation master plans, land use documents, and other related policy documents were key tools used to regulate road freight. Further, respondents working at regional and municipal levels noted that their organizations had developed either 1) specialized and targeted studies associated with curbside management, the right of way, and other freight or freight-adjacent topics, or 2) had developed an explicit goods movement strategic plan.

Just under half of the respondents spoke to the collection and analysis of data from external sources. Sources included other levels of government, private sector actors, or academics through established partnerships.

Applicable data was mapped out in geographic information systems (GIS) or used as key inputs into travel demand modeling. It is important to note, however, that travel demand models were not often developed for primarily road freight use, and that their use in managing logistics is often a by-product rather than an explicit objective or rationale for developing such tools.

Regional governments and respondents with the federal government or crown corporations all spoke about the use of freight forums, task forces, and related governance bodies as key tools for managing road freight. These forums were intended to provide engagement opportunities between government and the private sector, to manage relationships between agency operations and trucking firms, to ensure a high level of data quality, and to address freight-related matters such as safety and the flow of goods at the regional scale.

As will be discussed below, only one respondent noted the use of financial measures to manage road freight. A number of tools were mentioned that are not currently widely used, including pilot projects, procurement policies, academic partnerships, and moral pressure or suasion.

Table 2.1 Road Freight Tools by Participant

	Quebec		Ontario				New Brunswick	Nova Scotia		Canada
Tools	Regional	Municipality	Regional	Regional	Provincial	Municipal	Municipal	Crown Corporation	Crown Corporation	Federal
Marketing Tools		X								
Goods Movement Strategic Plan		X	X	X		X				
Procurement Policies		X							X	
Financial Measures (tax cuts, levies)		X								
Forums, Task Forces or Governance Boards			X	X					X	X
Pilot Projects		X					X			
Data Production and Collection (in-house)					X			X	X	X
Data Production and Collection (External)				X	X			X	X	X
Specialized and Targeted Studies		X	X	X		X	X		X	
Travel Demand Modeling and Forecasting					X	X		X		
Policy and Guideline Development (By-laws, TMPs, Master Plans, etc.)	X	X	X	X		X	X	X	X	X
Academic Partnerships				X			X			
Mapping and Geographic Information Systems (GIS)				X		X		X	X	X
Moral Suasion and Pressure										X

Public sector actors engage each other frequently and with general ease

All respondents noted that they regularly engage with other levels of government. As one participant noted, fostering strong, ongoing inter-governmental collaboration was important because “goods movement does not end at a particular municipal boundary. It even does not end at the boundary of our country, either” [IN2]. Regardless of the size of their organization, it was generally noted that collaboration on road freight management was frequent and generally characterized as positive, with one participant noting that engagements are “not seamless but overall work well”. Respondents noted that they were engaging different public sector bodies daily to a few times a month, depending on the file, and depending on the specific questions of jurisdiction and accountability over given assets (e.g., the road network, freight and industrial facilities, transport modes).

Differences in the quality and ease of engagement were perceived to arise depending on the interests, values, and objectives of the different agencies involved. One respondent who works in a provincial ministry explained that engagement isn’t “uniform across the board. It’s kind of various, depending on the area and also the specific project in mind. So, [if] it’s a long range, regional plan, the engagement will be more collegial” [IN3]. The context and project specifics were perceived to impact the quality and tenor of engagement, and part of this stemmed from a question of how provincial interests and other stakeholder interests diverged. When there was an alignment of interest on a project, such as a road expansion, the form of engagement is generally seen as being through the sharing of information, and the tenor is often collegial in nature. Another respondent noted that generally, there is alignment between different levels of government on initiating road freight projects, the question was how such projects should be completed:

> It’s mainly about how to accomplish some of those things. You know, we want to take this path and an agency wants to take a different path. Everyone agrees that…as an example, we want to do something about mode shift — getting more people out of single occupant vehicles onto other forms of transportation. Generally, my position is to do that faster, but other agencies think: we need to take a more measured approach, or we need to do this and this first. It’s not that we don't agree about the fundamental principles [IN4].

Two respondents spoke to how changes in corporate leadership positively impacted the quality of partnerships and engagement. Where previous engagements were characterized

as “reading tea leaves”, the hiring of a new CEO reduced the red tape that inhibited engagement and resulted in staff having a “one-on-one basis” with their partners [IN10].

Finally, one respondent noted that engaging with their provincial government is both smooth and challenging, depending on the ministry involved. As a planner at a regional agency, they noted that they have regular engagements with their respective ministries of housing, transportation, and environment, and that ongoing contact with the ministry of transportation was difficult as a result of regular staff changes and a lack of clarity over who to contact. This was contrasted with the “openness, transparency, and partnership” they have with the ministry of environment [IN5].

There are recurring challenges to smooth intergovernmental collaboration, though these are not seen as insurmountable

Respondents identified a number of recurring challenges that complicate intergovernmental collaboration. It is important to note, however, that none of these challenges were perceived as insurmountable, with some respondents even highlighting that they perceived no significant barriers to collaboration [IN3, IN6, IN8].

Prioritization and Alignment on Regional Goals. Respondents noted that both prioritizing and finding common ground to pursue projects that meet regional goals and outcomes was a significant challenge. For one, regional projects often transcend municipal or regional boundaries, meaning that agencies have to allocate resources (staff, and sometimes funding) to work on projects that are “outside” of their normal jurisdiction. As one respondent highlighted, regional projects regularly require:

> getting different actors to focus on regional collaboration rather than thinking about in-house projects. This is a question of prioritizing tasks. Often the projects this person works on involve other departments internally, but it’s not their primary accountability to work on it, so it sits on the corner of their desk [IN4].

The respondent perceived that such projects were less a question of having more staff working on them, but on ensuring that actors with different agencies have the support to prioritize collaborative, regional work. Given that freight and road networks often have responsibilities split between different municipalities, regional governments, and provinces, there are multiple actors involved in decision-making who may have different ideas about the

direction and strategic vision of where road freight should be located, what roads they should traverse, and other considerations, “even though it’s really one transportation network” that a vehicle is traveling on [IN4].

Some respondents noted that even internal alignment on road freight and industrial land use can be challenging (IN10, IN3, IN7). Within a government agency, different departments may have different goals and desired outcomes. This requires finding a common ground where actors can agree on an outcome and chart a path forward. The effort of getting buy-in from different government actors often requires the initiating party to “show everybody that we have shared priorities” [IN10].

Finally, an additional alignment challenge identified by one respondent was that managing industrial land uses to balance city-wide needs at the macro-level (such as economic development) with neighbourhood level needs (such as safety and livability) at the micro-scale. Goods movement and industrial flows are often an essential part of a city’s economy, though it was noted that at the local level, resident perceptions of safety, congestion, pollution, and other nuisances associated with freight may result in local planners feeling hesitant about allowing logistics uses within their borders. The respondent further noted that:

> The problem is that logistics uses aren’t seen as the optimal land use in most of these boroughs...These boroughs that are not as welcoming to this industry would be interested if these companies — these logistics companies — were interested in having a better development model for their land. For a borough planner, that’s probably the biggest thing, where it’s not [an] optimal land use [IN1].

Respondents put forward three general recommendations for overcoming alignment and prioritization challenges. These included:

- *Keeping regional mandates broad to ensure buy-in from as many stakeholders as possible.* It was noted that respondents “come to the table” because they perceive a benefit to collaboration and to mutual support between agencies [IN2, IN4, IN6]. Multiple respondents noted that freight forums or governance boards are a means of getting different public, private, and academic actors together to collaborate towards a common goal [IN2, IN6, IN9].

- *Working collaboratively to identify regional priorities and work plans to action them.* Without a clear sense of direction on what work should be prioritized, it can be hard to realize regional goals. As one respondent noted, you can be told that goods movement is a regional priority, while knowing that there are other, more pressing issues that should be worked on [IN4]. As such, there is a need to build alignment, both within government bodies and at a regional level, to ensure efforts and resources are properly allocated.

- *Allocate efforts to build the political and social permission to prioritize goods movement.* Respondents highlighted that goods movement is often under-considered and under-valued in their jurisdiction, and that there is a need to build political and social support for initiatives that optimize the flow of road freight. Part of this could involve communicating to politicians what the long-term benefits to prioritizing goods movement, and how those may relate to shorter-term interventions that concern councillors and their constituents. One respondent noted the need to sensitively communicate regional projects so that partners "can see the bigger picture and see that we're not circumventing process or making decisions in isolation. That's a key thing when dealing with other levels of government" [IN9].

Funding. Respondents noted that funding constraints often coloured the tone of intergovernmental collaboration. Participants perceived that when actors were invited to collaborate and had an interest in a project but were not financially accountable, collaboration was smooth. It was noted that funding constraints resulted in three challenges. First, concerns about the financial viability of projects were sometimes used to shut down conversations between agencies before they had gotten off the ground. Second, the lack of funding from higher levels of government sometimes results in municipalities within the same region competing "to win a project at any price" [IN5] at the expense of properly measuring the full extent of risks, and whether or not the winning location for a project is beneficial on a regional scale. Third, a lack of federal and provincial funding was perceived to be misaligned with mandates from those very governments to decarbonize at local or regional levels. Moreover, two respondents noted having to make difficult trade-offs between maintaining existing infrastructure ("keeping the nuts and bolts running") and new freight and decarbonization projects [IN10, IN11].

Two respondents noted that mitigating the impacts of funding challenges requires higher-levels of government—namely federal ministries and provincial departments—to have their investments follow established strategies [IN10, IN11]. If a strategy outlines decarbonization measures, then the agencies responsible for implementing such measures should receive adequate funding to fulfill the strategy. It was noted that without access to adequate funding, many road freight projects are likely to fail [IN2].

Organizational Compartmentalization and Capacity. Respondents perceived that many of their peer government agencies are compartmentalized and have internal silos between departments or ministries. This results in a lack of awareness within agencies on what work is being done, how and why decisions have been made, and if there is internal support for regional projects. For external actors, this results in difficulties knowing who the right people to engage are, creating conditions that slow down regional collaboration when multiple distinct departments within an organization need to sign off. As one municipal respondent noted: “When [we’re] dealing with levels of government larger than us, it is sometimes hard to know who to deal with. One person could say ‘yes’ or ‘maybe’, and another person could say ‘no’” [IN7].

Another respondent characterized this challenge as “playing musical chairs” with staff not remaining in their positions long enough to have collaborators with institutional knowledge of previous decisions. Discussions stop and start as public staff trickle through a department, and “when the people change, the positions taken change too” [IN9]. These conditions create a complex division of labour across internal teams and external partners with unclear accountabilities and poor communication (IN3, IN7, IN5). These ongoing staffing problems result in general capacity problems, where there are insufficient staff to give road freight and regional collaboration the attention it requires, creating conditions in which there is a “lack of a door to open when you have questions” [IN5]. In other words, there are staff who have not prioritized regional collaboration, who lack the institutional knowledge to know how and why decisions have been made, and are therefore unable to be effective collaborators when working with partners.

Respondents noted that the most effective remedy to public sector capacity challenges and compartmentalization is to foster an environment where it is possible to learn from and with peer agencies [IN9, IN6, IN3, IN4]. This means establishing opportunities where staff

expertise and knowledge—both within and outside an organization—can be drawn on. Part of working towards better regional coordination means knowing who to speak to, and this was perceived as possible in environments where staff have open door policies that facilitate relationships. Respondents also noted that tackling compartmentalization requires educating others on the objectives, actions, and dispositions of their respective organizations, as well as a greater degree of information sharing. Questions that respondents deemed important to ask included: what are other agencies doing right? What ideas could work in our jurisdiction that our peers are testing? What goals are shared between regional actors?

Respondents identified a range of tools and strategies that could be introduced and implemented to improve goods movement.

Respondents were prompted to consider what tools and strategies they thought would benefit both their organization's management of road freight, and the transportation system more generally. Some of the key interventions included:

Optimizing existing industrial land uses, road infrastructure, and goods movement tools. There was a perception amongst respondents that their organizations, and by extension, the different actors who manage and shape the transportation system are underusing the existing repertoire of tools and strategies. Once respondent characterized this in relation to road expansions, noting that it is relatively easy to get funding and approval to widen a road "because we've always been in expansion mode", while their organization has failed to evaluate the use of existing road space: "when it comes to optimizing or making better use of what's already out there, we have not pushed it to the limit in terms of what could be done" [IN3]. Building on this, the respondent explained that the general management of demand on the transportation system has been piecemeal with "tools that are there but not used to the fullest" [IN3]. Examples of optimizing the transportation system included introducing preferential lanes for commercial vehicles to increase both lane and network capacity [IN3, IN9], the development of intermodal hubs and railroad rehabilitation that promote modal shifts [IN5, IN10, IN7, IN4], and developing freight villages and industrial hubs [IN1, IN2]. Modal shifts were also noted to have co-benefits in increasing the resilience of Canada's transportation system [IN8], and saving public money [IN9]:

> We can look at optimizing the space we have today, which would then give us a better idea to: Are those dollars well spent?

> Because these infrastructure projects, modifications to bridges, widening of highways, they just add capital dollars.

Eco-fiscal measures, or pricing goods movement. Respondents repeatedly mentioned that the suboptimal placement of logistics facilities is in part a question of the availability of industrial lands in suburban or peripheral segments or major cities, and in part the result of private actors making concerted decisions to locate where industrial land is inexpensive but still within proximity to major urban centres. To mitigate this freight sprawl, respondents proposed implementing eco-fiscal measures. These could include putting a price on the use of the transportation system by logistics operators through a mileage tax for trucks or larger commercial vehicles, curbside pricing, or low emission zones that charge drivers for the use of certain classes of vehicles. Pricing mechanisms are intended to direct the behaviour of road freight operators. As one respondent explained:

> Charging people or charging companies for the actual use they make of the road system, as well as the transportation system in general...would bring us in the direction where we can actually get to...a lower-carbon transportation system and a more coherent land use...I think it's especially important for these transportation costs to be internalized by companies who made this decision to look at outside the city [for their facilities], because they're driving development – not just industrial development, but also residential development further down the road [IN1].

Land use regulations, in providing a framework for the type and placement of urban development, were perceived as insufficient to properly direct logistics development: “you need to hit them in the wallet” [IN1].

Another respondent noted that a barrier to introducing pricing measures for road freight was a lack of political will: “we have not been able to get a political vote to say pricing is a tool that can have an impact in the way you can manage demand” [IN3]. Road design interventions, such as road treatments that favour trucks and segregated truck lanes were not deemed sufficient. One respondent perceived that part of the challenge in pricing goods movement/commercial vehicles is that such mechanisms are understudied in Canada.

Reframing goods movement for both the public and professionals. Respondents generally felt as though the complexities of managing goods movement were poorly understood by both residents and political actors in their jurisdictions. A tension was identified

between the desire to see the efficient delivery of goods to both one's home and to stores, while also being reluctant to tolerate some of the negative externalities associated with freight (e.g., noise, congestion, etc.). As one respondent commented, goods movement should be considered "more highly, but I think, you kind of get to the point of people just consider[ing] themselves as drivers" [IN7]. Almost all respondents noted that road freight was a vital economic driver, and that reconciling resident needs with the needs of logistics operators required both a higher degree of knowledge of how goods movement operates and why it is important to have the efficient movement of trucks to destinations such as stores and warehouses: "How can we navigate, you know, these trucks through the city in a more efficient way on routes where they'll be less impactful on the community, right?" [IN6]. Some respondent's jurisdictions have started to roll out educational material aimed at both professionals (e.g., a goods movement primer course), and at residents (in the form of pamphlets explaining how goods are delivered in their cities or regions).

Another strategy that respondents spoke to was to shift how professionals approach transportation planning and urban development. Planning for new development was identified as often prioritizing parking and the fluid flow of cars over goods movement, pedestrians and active transport users, and transit riders [IN4, IN7]. Shifting away from a car-centric way of city-building that prioritizes traffic mitigation was proposed as part of this culture shift:

> To not think about traffic...we've been conditioned to worry about: "Oh, it's traffic [that is] going to get worse". Most resources go towards mitigating traffic. I kind of feel like we need to change the culture, kind of reframe things. It's not that traffic is going to get worse, it's that we're giving people an option [by providing transit or active transportation options]. We're not going to be able to satisfy this unlimited demand for driving...We focus on the core aspects of making traffic better, but we don't focus on the core aspects of other modes.

The respondent articulated that when transportation planners and engineers are designing roads all day, it's hard to think about alternatives. As part of this cultural shift, other respondents associated densifying existing lands to curb suburban sprawl, higher density housing, and the construction and maintenance of active transportation and transit infrastructure as complementary to a well functioning goods movement network.

Develop provincial and Canada-wide goods movement strategies and funding mechanisms. Given the trans-border nature of goods movement, respondents noted that

planning for freight facilities and the transportation network at both the municipal and regional level requires both short-term and long-term action plans. Speaking to the development process, one respondent said:

> If I were to develop a freight village, or if I were to develop an enterprise zone, you cannot do it overnight. It requires several years of planning, and official plan amendments, zoning by-laws, and development applications. Plus, we [would] want to make sure that we are providing the infrastructure necessary: water, wastewater, roads, electricity, plus internet, high speed. So, all those things are very necessary, and at the municipal level, this could be only achieved if you have a longer-term vision [IN2]

Absent from this process are provincial and Canada-wide good movement strategies that address trans-boundary freight flow. It was noted that such strategies could be similar to long-range plans, outlining scenarios for goods movement development over a 20, 50, or 100-year timeframe, and across road, rail, air, and marine freight. Such plans were perceived to help bolster the resilience of Canada's transportation system.

A component of such strategies would be corresponding provincial and federal funding. While there has been recent pressure for provincial and federal agencies to increase transit funding, with groups such as CUTA lobbying for nation-wide investments, there have been no comparable strategies for goods movement [IN2, IN3]. One respondent noted that part of the challenge is that the profile of goods movement is not comparable to that of transit, while highlighting that residents worry about truck traffic and safety while there is no "well-establish[ed] funding mechanism" nor "a well-established longer-term visions [sic] [and] plan, and a structure" to address such worries and the current state of Canada's goods movement network [IN2]. Multiple respondents noted that Canada's road freight system lacked resilience, especially when traveling eastward into Nova Scotia over the Chignecto Isthmus.

Prioritizing road freight decarbonization. Within the context of respondent comments on the lack of long-term provincial and federal strategies, as well as the need for further freight-specific funding, it was noted that there is an overall need to prioritize road freight decarbonization. Respondents noted that federal support for emissions reductions and filling in the gaps in existing charging networks would help advance the uptake of electric medium- and heavy-duty vehicles. Moreover, it was noted that the general electrification of internal combustion vehicles—explicitly noted to be a stopgap measure in broadly decarbonizing

transportation—would also benefit road freight decarbonization. Part of commercial vehicle decarbonization was perceived to involve helping residents to shift out of their personal vehicles and onto public transit and/or active transportation. Other initiatives to prioritize road freight decarbonization mentioned included forming research partnerships with the private sector and academic institutions, greater exchange of information and data between operators and government actors, and further advancing the digitalization of Canada's supply chain to support the efficient management of Canada's transportation system.

Two respondents noted that government pathways to decarbonization are often non-linear. Even projects that are not explicitly connected to decarbonization may benefit or contribute to Canada's climate goals through emissions reductions, electrification of existing assets, fuel shifts, and so on.

The role of the public sector is to generally create conditions for the private sector to decarbonize road freight

When prompted about the perceived role of the private sector in road freight decarbonization, most respondents answered by explaining the public sector's perceived role. Overall, most respondents noted that the role of the public sector is to establish regulations, frameworks, and accountabilities, to identify problem statements or challenges to be addressed by academics and the private sector, and to govern road freight decarbonization. Respondents further noted that the work of road freight decarbonization is expected to fall to private sector actors and operators, and that meeting decarbonization targets set by the public sector is contingent on the money, resources, and time to implement new delivery methods, to transition to electric fleets, to develop and implement new battery technologies, and other interventions. One respondent further explained that without the help of private organizations, the public sector would be unable to meet their decarbonization goals and targets: there is a need for the public sector to "get their [private sector] support, if we don't get their implementation power, it [decarbonization] would not work" [IN2].

Conversely, respondents noted that they expect private sector actors to work collaboratively with them by providing access to data, and providing funding for road freight initiatives and research. This may be challenging, however, as the perceived motives to decarbonize include responding to customer demands, public pressure to decarbonize, and to be competitive. As one respondent put it, the private sector looks at road freight decarbonization from a "financial

point of view": If I'm making enough money, then why do I care? How do you make them aware of these impacts that they're creating? So that's the regulation and the education comes from the public [IN3].

In other words, without a strong regulatory framework—set by the public sector—private actors won't change their behaviours and decisions unless there is a push to.

One respondent noted that the public sector is well positioned to show private actors "that new economic models, new transportation models can actually work" by working collaboratively on pilot projects [IN1]. Within this context, the public sector not only establishes the regulatory framework for road freight decarbonization through by-laws, guidance on zoning, and road freight strategies, but also provides test locations and data. Test locations may include underused buildings, parking lots, and other public locations that may be appropriated for cargo deliveries or pick-up locations for residents. Freight companies can then "use this data, these ideas, these innovations. They're the ones doing the innovation. We're providing the framework for them to do the innovation, but we don't really do it by ourselves, we can't do it by ourselves, because we're not transportation operators." [IN1]. In this way, both the public and private sector are working to shape decisions about fleets, delivery models, and new trucks, and therefore:

> directing the market. So, if they're also being the leaders in terms of transitions from traditional vehicles to electric vehicles, or to smaller vehicles as well, it also gives a signal, not just to the logistics companies, but also to other parts of the economy. So, I think they have a role in both innovating, so that we can actually get towards a carbon neutral economy, and also a leadership role, especially with the major companies [IN1].

The public sector thus plays a supportive role in setting conditions that allow for private firms to decarbonize. Pilot projects were also noted to be a means of having both the public and private sectors working in lockstep to achieve a common goal.

Some respondents stated that the responsibility for decarbonization transportation is so significant that it "can't come from private enterprises" because their general mode of operating is "business as usual" and thus does not include "a program to improve society" [IN5]. As a collective issue, responsibility for decarbonization should primarily be within the public sector. Another respondent also noted that while private actors tend to speak to the

benefit of decarbonizing their fleets and delivery models, they want to see more action on the part of companies. It is understandable that private firms go where they expect profits to be, but there is a sense that there needs to be strong social responsibility for the carbon emissions produced by private actors in goods movement.

Residents play an important but limited role in promoting road freight decarbonization

Most respondents spoke to the value of having residents involved in plans to decarbonize road freight. However, it was perceived that the general population often does not have the background to understand the complexities of transportation planning. The public sector was perceived to need to do a better job explaining to residents the environmental impacts of consumer items and getting products delivered, as well as why decisions about freight routes and logistics facility locations are significant.

Support from the general public was perceived to be important to advance goods movement decarbonization: to have goods movement policies that are effective requires political buy-in, and political buy-in necessitates broad public support. As such, the public sector was noted to play an integral role in informing residents about goods movement, and in turn, shaping resident behaviour in ways that promote road freight decarbonization. Respondents spoke to the role of residents in voting for politicians who support their values, spending money in ways that support decarbonization, and informing themselves of the consequences of their choices when it comes to the delivery of personal packages. There were further questions about whether it is necessary to have next day delivery, and if packages need to be delivered directly to consumer homes or if elsewhere could suffice. Residents were also noted to have the power to advocate to their representatives to make the case for emissions reductions in their communities.

NIMBYism (Not In My Backyard) was noted to be a significant barrier to effective public involvement in road freight decarbonization [IN5, IN7, IN8] stemming from a general lack of knowledge of road freight and goods movement that impedes meaningful involvement in the planning process. One respondent noted that “residents impede meaningful conversations about freight” [IN7] by focusing on personal inconveniences of living near logistics facilities or truck routes, even in instances where such infrastructure pre-dates them living nearby. Some respondents thought that involving residents may hinder goods movement initiatives: “It is

something that's rather abstract. There are a lot of land use planning and mobility issues like that. People tend to want one more highway lane, a new highway, a new port, without really understanding what is at stake, because at the end of the day, it could save them time" [IN5]. The focus on personal interest in infrastructure projects was perceived to be an impediment to regional goods movement planning. Building on this, one respondent highlighted that private companies require a stable regulatory and market environment in which to operate, and that NIMBYism may also result in poor regional planning of goods movement facilities:

> There has to be uniform policies, and businesses should be able to locate because of access to roads, access to highways, access to services, rather than one municipality trying to lobby the other businesses to locate [in their city]. And that's where I think we need to make sure that even people are aware of it, that they cannot have that not in my backyard [mentality]. And plus, they want to go to the nearest grocery store to get their toilet paper [IN2].

2.6 Discussion: Pathways for strengthening efforts to decarbonize road freight

2.6.1 Optimizing existing infrastructure, tools, and strategies

In an environment where public-sector capacity and expertise is constrained (Mazzucato and Collington, 2023; Levy, 2021; Easterling, 2014), funding is limited (Levy, 2021; Doern et al.; 2021) and government partners act in silos to manage regional transportation systems, it is vital to consider how to use existing assets, tools, and resources is vital. Many respondents spoke to how their existing tools and road freight assets were underused and could be optimized. In a context where infrastructure investment is often political and tied to election cycles (Doern et al., 2021), it is important that local and regional governments identify ways to optimize their existing transportation networks and refine their existing tools and strategies. In a funding- and knowledge- constrained environment, this is one way to weather the cyclical nature of political commitments to transportation.

Respondents spoke to a desire to see their existing networks and tools used more efficiently, or right sized to their needs. For example, it was observed in the course of interviews that many respondents were in control of tools and strategies that were underused. This included the road network itself and existing fiscal and planning tools.

Many respondents spoke of a hesitation to implement pricing mechanisms for road freight. Such eco-fiscal tools would allow municipalities and regions to optimize the use of

assets under their control, such as roads, highways, and bridges (Doern et al., 2021), while generating revenues that could go back into funding road freight planning decarbonization initiatives. Municipalities in Quebec, for example, have direct (though limited) powers to impose taxes for regulatory reasons to influence behavioural changes in those charged and to impose “price tags” on “access to public services” (Tremblay-Racicot et al., 2023). Such taxes may take the form of a parking levy (Mepham, 2024; Tremblay-Racicot et al., 2023), vacant house taxes (Gallmeyer, 2021), or in some jurisdictions, congestion pricing or mileage taxes (Anas, 2020; Domon et al., 2022). One respondent who works at a municipality in Quebec noted that while such eco-fiscal mechanisms exist in the province, they are currently not widely used [IN1]. Other municipal jurisdictions (including those in Ontario), also have limited powers to impose levies, though there is often no political will (Kim et al., 2023). One provincial engineer in Ontario noted that a usage- or mileage-based tax on road freight was not politically feasible.

There are transportation network and land use interventions that have yet to be widely implemented in Canadian cities. Respondents spoke of network and land use interventions to support road freight that do not have widespread adoption to date. This includes dedicated truck lanes to improve lane and network capacity, which TAC (2014: 3) notes “are a relatively new concept which is under-researched and sparsely implemented”. Other interventions included the expansion of railroad infrastructure to promote modal shifts for freight (Kaack et al., 2018), the development of freight villages (Higgins and Ferguson, 2011), and the implementation of mobility hubs. Freight villages have been developed in some Canadian jurisdictions, including Peel Region (Region of Peel, 2020), Calgary, and Winnipeg. Freight villages allow for the development of economies of scale, cost sharing between private firms, and ease of servicing (Higgins and Ferguson, 2011) while offering up a possible means of concentrating and locating a range of industrial activities. Good planning of freight villages can also coordinate transit to and from industrial areas for workers and spur the development of housing [IN2]. Mobility hubs are a means of consolidating a range of active transportation, transit, and supportive activities within a concentrated area (Roukouni et al., 2023). Often, mobility hubs are around major transit stations or key destinations such as hospitals and schools (Arnold et al., 2022; Aydin et al., 2022). One of the supportive activities or services provided by mobility hubs is parcel collection for residents (Axinte et al., 2023; Chetouani et al., 2023; van Duin et al., 2023). Two respondents noted that they are piloting the use of

mobility hubs for parcel pick-up by residents, with the aim of reducing truck traffic in dense municipalities, limiting the need for deliveries to resident homes, and to test new delivery models [IN1, IN6]

Data collection and analysis for road freight is often secondary. Respondents noted that they use mapping tools and geographic information systems, travel demand modeling, and other analytics tools to forecast goods movement. However, many noted that they have insufficient access to the right data, or that the models they are using were not developed for the purpose of analyzing goods movement. The use of such models to consider freight is a secondary use. As such, there are data gaps (Kim et al., 2023; Wiginton, 2017), both in the availability of data from other governments and from private firms, and in bespoke or specialized models that allow public sector actors to make informed decisions about road freight.

2.6.2 Regional systems, local responsibilities

From a driver's perspective, when traveling from Vaughan to downtown Toronto, they are using a single road network. However, responsibilities for the management of the roads, highways, and associated infrastructure are divided between federal, provincial, and municipal bodies (Doern et al., 2021; Lightstone et al., 2021; Lawson, 2015). Different assets within the same municipal or regional boundaries may have different owners with distinct accountabilities, objectives, and priorities. As such, the effective management of road freight requires close collaboration between the different levels of government [All respondents].

For municipalities, the transboundary nature of road freight is especially challenging. Since the beginning of the 21st century, "the federal and provincial government have tended to download responsibility for infrastructure and services to municipalities" (Doern et al., 2021: 67). As creatures of the province, municipalities have limited funding and governance powers for regional matters, and must collaborate with other levels of government for major capital projects, including transit and roadway expansions (Gore et al., 2010; Doern et al., 2021; Horak, 2012; Kim et al., 2023; Hutton; 2012; Bherer and Hamel, 2012). Within this context, municipalities have become responsible for assets that they do not have the powers to adequately govern and that should be governed at the regional level. In Ontario and Quebec, road freight is often planned at both the municipal level (Brazeau et al., 2021; Wiginton, 2017), and at the regional level by Upper-Tier Municipalities (Saiyed et al., 2012) and regional county

municipalities (MRCs), respectively. While smooth collaboration may result in regional and local alignment on freight planning [IN1], in other regions, there may be political, technical, or structural barriers to collaboration, resulting in a lack of alignment on road freight (Kim et al., 2023; IN5).

A valuable step forward for public sector actors would be to consider how governance tools, strategies, and powers could better align with the system or transportation network in question. Given that much academic and institutional discourse on road freight focuses on infrastructure regimes (Doern et al., 2021) or sectors as distinct (Galvez and MacDonald, 2018, Seattle et al., 2021, Leiss, 2022), a holistic approach to road freight may help solidify the need to structurally reconsider how responsibilities for transportation are allocated. For instance, considering road freight as a sub-system of Canada's larger transportation system allows us to view its interdependencies with sustainable and "smart" development/growth (Aderneck, 2023; Hatuka and Ben-Joseph, 2022), transit infrastructure (Barnett, 2021), and economic development (Lorius, 2022; Woudsma, 2013). Respondents noted that their work on road freight considered labour pools, housing and urban sprawl, the placement of active transportation and transit infrastructure, the allocation of local and regional land uses, and regional economic development. These interdependencies are also regional or transboundary in nature, adding further complexity in addressing the growth and development of cities and regions (Barrett, 2021). As such, the question is not just how to consider road freight as a regional asset, but how to consider road freight as part of the larger regional system that encompasses other competing priorities and sub-systems. A reconsideration of the scales (geographic and temporal) over which we aim to manage road freight and its related challenges is needed (Barnett, 2021; Buck, 2021). To date, there are few pathways for lower levels of governments in Canada to influence their responsibilities, though some interest groups such as CIP and the Federation of Canadian Municipalities (FCM) do act as advocates[3].

[3] While it is outside the scope of this thesis, it is valuable to consider the role of not-for-profits and charities play in shaping policy around climate and transportation. There are a range of not-for-profits who are working on environmental justice and climate policy in Canada. Some of these include Ecojustice, Environmental Defense, the David Suzuki Foundation, and the Ecology Action Centre. While road freight decarbonization may be a pressing issue, it is not necessary directly in the mandate of any of these not-for-profits (though it may fall under transportation projects or initiatives more broadly). It is valuable to consider how American organizations and activists have successfully mobilized around road freight infrastructure. For example, the People's Collective for Environmental Justice was successful in persuading the California Air Resource Board to adopt the *In-Use Locomotive Rule* and the *California Advanced Clean Fleets Rule* that aim to mitigate the pollution from the transportation sector, and in particular, logistics and warehousing emissions (Lakhani, 2024). The advocacy to adopt these

2.6.3 Coupling road freight and decarbonization

While respondents spoke to a personal concern and interest in decarbonization, most stated that they do not work directly on such initiatives in the course of their work, nor do their organizations explicitly link decarbonization and road freight. A couple of respondents spoke of limited overlap between road freight and decarbonization on specific projects or programs they contribute to [IN7, IN11], though such engagements were often in support of other departments or internal actors. The lack of an explicit connection between decarbonization and road freight amongst respondents is unsurprising. In general, road freight—and industrial land uses more generally—is often under considered in land use planning (Kim et al., 2023; Aderneck, 2023).

While further research should explore the structural and historic reasons that land use planning has under considered road freight, one part of the explanation may be that transportation in general is considered "hard-to-decarbonize" (Buck, 2021). When we speak of a system as hard to decarbonize, it is important to clarify whether we mean that it involves components that are socially-, economically-, or technologically- hard to decarbonize. Buck (2021, 54) asks us to consider that "what's feasible is conditioned by assumptions about several things, including (a) markets, (b) the role of the public and public power, (c) technical change, and (d) what governments can to do [sic] support change". There may be instances where we have the technology or policy tools to facilitate or advance decarbonization efforts, but there is a lack of social permission to implement them. The implementation of fiscal mechanisms to price road freight or the deployment of dedicated trucking lanes mentioned above are examples where social acceptability and a lack of political will make road freight decarbonization "hard" to accomplish.

Transportation is considered a "hard-to-decarbonize" sector in part because of the interrelationship between economic growth and growing demands for transportation infrastructure, such as roadways, and highways (Bannister et al, 2011; Noussan et al., 2020; Ghisolfi et al., 2022a). While planners and the tools and strategies they employ in region and city-building may help direct economic growth and urban development, a concerted effort

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regulations was grounded in the struggle for environmental justice for communities who live near logistics facilities and experience the negative health impacts of living in proximity to them (Lakhani, 2024). This work may be understood as part of a larger environmental justice frame with which to understand infrastructure projects in the United States (see Agyeman, 2013; Pellow, 2016; Scott, 2014). There are future possibilities for joining up environmental justice and road freight for not-for-profits in Canada. For an overview of some recent not-for-profits, governments, and non-governmental organizations engaged in equity and justice focused work, see Amatullo et al. (2022).

across scales and government actions is needed to address transport challenges. The distributed accountabilities for the road network and the multi-level governance structure that oversees goods movement means that no one level of government is capable of “owning” road freight, let alone advancing efforts to decarbonize it. As such, without a concerted effort to align and coordinate efforts, policies, and actions across local, regional, provincial, and federal actors, road freight and decarbonization will remain decoupled.

2.7 Conclusion

As respondents attested, road freight decarbonization is about more than the road, trucking, or warehouses. It is a question of regional coordination, the structural distribution of responsibilities between different levels of Canadian government, the alignment of policy, values, and funding, as well as technical interventions.

This chapter has sought to explore the perceptions of public sector planners and engineers who have responsibilities for road freight decarbonization. Overall, it was observed that the decarbonization of road freight was a minor responsibility for most respondents, though there is strong interest in pursuing policies, strategies, and interventions that decarbonize goods movement. With this in mind, three areas of future research would help to promote further public sector action on road freight decarbonization, including:

- Studying how changes to Canada’s governance structure could facilitate better management, not just of road freight, but of other domains, such as transit. This could include exploring if regulatory powers could or should be relegated to municipal or regional actors from the provinces or the federal government.

- Studying how the general public understands and perceives different policies and interventions that support road freight decarbonization. Multiple respondents spoke to the importance of public buy-in from residents, while highlighting a lack of knowledge of goods movement as a barrier to effective public support.

- Studying how the public sector and private sectors cooperate and interact in the management of road freight. As the “doers” of goods movement, the private sector has significant leverage in shaping the regulations and governing framework developed by public sector actors. Conversely, the public sector has untapped and

underused capacities that could be directed at shaping the behaviour of private sector actors.

Road freight exerts an enormous influence on economic growth, development, and land use patterns. To poorly govern road freight means the poor management of cities and regions. Decarbonizing road freight is a critical lever that could advance Canada's net-zero aspirations. Empowering public sector planners and engineers to collaboratively manage the road is an essential—and to date understudied—area of research.

CHAPTER 3

CLIMATE CHANGE, TRUST IN GOVERNMENT, AND THE GOVERNANCE OF ROAD FREIGHT: POPULAR OPINIONS ON INFRASTRUCTURE IN ONTARIO, QUEBEC, NEW BRUNSWICK, AND NOVA SCOTIA

3.1 Introduction

The previous chapter explored how public sector planners and engineers collaborate and cooperate with each other when governing road freight. In speaking with public sector professionals, a recurring tension arose between the importance of engaging the public when making decisions surrounding road freight and the sense that there is an inadequate level of knowledge and understanding of the complexities of managing goods movement among residents. This was understood to result in "Not In My Backyard" (NIMBY) attitudes around the siting of logistics facilities and the designation of freight routes. In such interactions between public staff and residents, concerns about traffic, noxious materials, noise, and other negative externalities associated with living near goods movement infrastructure are contrasted with the local and economic benefits of housing road freight facilities within a given jurisdiction. Respondents noted that both the politicians who establish public staff mandates and the public they serve have insufficient knowledge to understand the complexity of road freight. In the opinion of some respondents, this lack of knowledge works to hinder discussions about managing road freight. This is part of the reason why hard-to-decarbonize industries may be classified as such for technical, social, political, and/or economic reasons—lack of public knowledge contributes to the social dimensions of decarbonization. In such an instance, respondents noted that there were social and political challenges that make road freight hard to decarbonize (notwithstanding complexities surrounding electrification and societal energy transitions).

Urban planners generally hold the belief that social acceptance and "buy-in" from residents is important in developing projects and in gaining the required political support to execute the planning work (Agyeman, 2013; Arnstein, 1969; Friedman, 1973; Young Foundation, 2016). A sense of democratic decision-making—although ultimately top-down[4]—is often touted by

[4] The planning profession often speaks to the value of bottoms-up or engagement heavy approaches to planning projects and development. However, the degree of engagement on projects varies from area to area. For instance, it is more likely that there is a robust framework to engage on issues such as transportation or land use planning than there is to engage on road freight

planners as key to city- and region-building; this is particularly true for transformational shifts to manage or arrest climate change (Buck, 2023; Agyeman, 2013; Lucas et al., 2021). As Buck (2023, 107) notes however, part of a democratic energy transition also requires politicians and advocates to question if they are “prepared for people choosing pathways or technologies [politicians and advocates] don’t like?”

Goods movement and economic development are regularly coupled in the literature on road freight (Woudsma, 2013; Bannister et al., 2011; Yan et al., 2021). Transportation more generally is seen as a critical industry and means of facilitating economic growth (Bannister et al., 2011). Within this context, growth is synonymous with economic well-being (Saito, 2024; see also Handy, 2023 for the connection between vehicular modes of travel and concepts of freedom). Where does this leave residents who have concerns about road freight facilities more generally?

The purpose of this chapter is to provide a preliminary sketch of the social dynamics of road freight. The aim is to understand how Canadians in Ontario, Quebec, New Brunswick, and Nova Scotia perceive state actors’ cooperation and collaboration, and which levels of government they believe should intervene in policies aimed at decarbonizing road freight. There is a wealth of literature on the public perceptions of the transition from fossil fuels and the social dynamics of renewable energies (Rhodes et al., 2017; Hughes, 2021; Walker and Baxter, 2017; Donald et al., 2021; Windemer, 2023; Gross, 2020). Conversely, there is a dearth of literature that studies the public perceptions of residents concerning road freight. Decarbonizing road freight and public sentiment are broadly under-studied. As Fried et al. (2023: 14) explain, “as warehousing and other distribution facilities concentrate many of urban freight's environmental and safety costs (Wygonik and Goodchild, 2018), neglecting the transport-related inequities generated by logistics land use decisions presents a scalar blindspot in research”.

This chapter proposes a way forward for future studies of the social dynamics of road freight. It sets forth a direction for research into how the governance of road freight may be influenced by public perceptions that shape policymaking and decision-making. In sketching out the social dynamics of road freight, we pay particular attention to how public perceptions of climate

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or logistics site-selection. Moreover, given that many logistics developments are driven by private landowners or firms, and already meet the by-law and development standards set in jurisdictions, there may be few “official” touchpoints for engagement required.

change and government action may be linked to better decision-making to decarbonize road freight. There is a perception gap regarding opinions on climate action, “wherein individuals around the globe systematically underestimate the willingness of their fellow citizens to act” to combat climate change (Andre et al., 2024: 253). Addressing this gap requires baseline information on what interventions people support, reject, or may not know enough about yet. What follows is a first attempt to provide policymakers and planning practitioners with evidence-based findings of how Central and Eastern Canadians perceive current levels of cooperation and competence at the local, regional, federal, and provincial level, and the degree to which they believe different levels of government should be involved in a range of interventions aimed at decarbonizing road freight.

The following two sections outline the current state of climate perceptions and trust in government amongst residents from the existing literature and how road freight decarbonization interventions are framed, respectively. As there is currently no substantive body of literature that speaks to social dimensions of road freight decarbonization and public perceptions, we draw on literature on Canadian and global perceptions of climate change mitigation, as well as the literature on renewable energy transitions. The results of our survey are then laid out, along with a discussion of our findings. We include lessons for policymakers and planners engaged in the management of road freight. We hope this research may contribute to the sense that there is general support amongst Canadians for interventions aimed at decarbonizing our road freight system. The question should not be “do we undertake these actions?” but rather, “who will be responsible for such interventions?”, “at what scales and timeframes should they be implemented?”, and “how will residents meaningfully be implicated in the transition to a greener transportation system?”.

We recognize that interventions aimed at decarbonizing road freight must move beyond individualized recommendations of degrowth and behavioral change as dominant frames for transformation, and focus on structural transformations of Canada's transportation system. As Buck (2023: 108) states:

> “Behavioral change” and “demand reduction” are clearly going to be necessary in some areas, though again, how this behavioral change is induced in a democracy is not clear, as the incentives-and-penalties approaches to shaping behavior appear unlikely to be implemented by voters at the scale needed to make a climate-significant differences.

This chapter addresses Sub-Objective 1.3 (Assessing public understanding and knowledge of governmental action to mitigate climate change) and Sub-Objective 1.4 (Identifying what level of government (i.e., municipal, provincial, federal) the public believe should be responsible for select road freight decarbonization interventions).

3.2 Climate Change and Trust in Government

Trust in government and belief in climate change as issues that deserve urgent response have both been dwindling as we advance through the 21st century (Joquin, 2014; Mazzucato and Collington, 2023; Jesuit, 2014; Hatch et al., 2024).

Trust in government may be associated with both the perceived fairness of policies and programs, as well as their outcomes (Jesuit, 2014; Walker and Baxter, 2017). In other words, both the procedural fairness of policies, as well as their outcomes matter when residents consider the performance of their governments. Other factors such as disinformation campaigns (Dembicki, 2022; CCDH, 2023; Delay, 2024), the privatization of key government functions and resulting lack of institutional knowledge and capacity (Bannister et al., 2011; Mazzucato and Collington, 2023), and one's political and ideological beliefs, gender, class, and race all contribute to one's sense of trust in government (Hatch et al., 2024; Kennedy, 2022; Lavigne et al., 2022; Jesuit, 2014).

In the literature on government responses to climate change, a lack of trust is often linked to a failure to meaningfully engage with residents. There is a perception that existing ways of engagement do not meaningfully integrate resident feedback, nor that the outcomes are meaningfully impacted by engagement (Walker and Baxter, 2017; Höppner and Whitmarsh, 2012). At a moment when urgent action is needed to combat climate change, properly engaging residents is a critical part of building trust in government actors and support for climate solutions (Höppner and Whitmarsh, 2012; Hughes, 2021). In their study on contrasting approaches to wind energy development and siting in Ontario and Nova Scotia, Walker and Baxter (2017: 168) found that "local approval of wind energy development was much higher under the less technocratic, bottom-up approaches" though "the absence of any real ability to affect the outcomes is what people are really concerned with". People want to know that the projects in their communities will have a positive impact on them, their communities, and the environment. They also want their opinions to be considered when governments make decisions.

In light of the findings in the literature, we pose three research questions related to trust:

RQ1: Do Canadians have a low level of trust in the different levels of government?

RQ2: Does gender impact one's sense of trust in government?

RQ3: Does one's Province of residents impact one's trust in different levels of government?

When asked about climate change, many Canadians are worried about both current and anticipated consequences from increasing carbon emissions, though more immediate concerns—such as affordability and housing—tend to diminish the sense of urgency to act (Hatch et al., 2024). Moreover, although Canadians show broad support for both government and corporate action to address climate change, Canadians' support diminishes when asked to assess specific policies designed to address climate change (Hatch et al., 2024). Hatch et al. (2024, 19–24) note that the prioritization of climate change among Canadians dropped from 40% in 2019 to 22% in 2023, though the prioritization of climate as a concern remains high in Quebec (84%), Ontario (71%), and the Maritimes (67%).

It is valuable to consider what might impact one's concern and desire to prioritize climate action. Different dimensions that may impact one's concern of climate action include: received narratives of climate transition, socio-demographic characteristics, and the degree to which residents have been engaged by governments in the past.

When we speak about decarbonization, we are speaking of a kit of technological and policy interventions aimed at limiting or eliminating the use of carbon-emitting fuels. However, decarbonization is not *just* about technology and policy. Underscoring these facets are larger cultural narratives that shape how we understand and relate to the chosen decarbonization pathways (Kennedy, 2022; Hughes, 2021; Bush and Clayton, 2023; Huber, 2013). Narratives are a critical way to understand one's sense of self and identity, national identity, and critical societal transformations, such as transitioning to a new transportation system or a low-carbon economy. Nye (1993) identified how the way we speak about "energy narratives" are shaped by how actors imbue energy with different cultural values, such as abundance, personal freedom, and productivity, and how control over resources is thereby allocated (Marx, 2022; Bush and Clayton, 2023; Chachra, 2024). Similarly, the way we frame transportation and

climate change is impacted by cultural narratives and values. One of the more common narratives about both transportation and road freight is that they represent economic growth (Woudsma, 2013). Such a narrative implies that to limit transportation and logistics development is to limit growth, at both the personal and the national level.

Much like different narrative constructions of energy, how people envision climate change depends on different framings and narratives. Kennedy (2023) and Martel-Morin and Lachapelle (2022) have identified different “eco-types” and “audiences”, respectively, that speak to the narrative dimensions about how people understand their relationship to the environment, and thus, climate change.

Kennedy (2023), through interviews with Americans, noted that there are divergent ways of being interested in and caring for nature that are often distinct along ideological, class, and gendered lines. These ways of caring for the environment are relative to an “ideal environmentalism” that puts the onus on climate change mitigation on the individual to make the right behavioral and consumptive choices (Kennedy, 2022). The narrative of an individualized and consumption-based form of environmentalism risks alienating those who care about the environment but do not have the financial or social means to confirm such an idea. As Kennedy (2023: 145) states: “some conservatives react to the cultural authority that the ideal environmentalist wields at this time and place, particularly because, in some ways, this ideal seems predicated on opposing the moral worth of quintessentially conservative eco-social relationships”. Imbued in the narrative are judgements about the right and wrong way to think about energy and climate transitions, with the right way reaffirming culturally liberal-elite (in the American sense) ideas of enacting societal change. In the same vein as Buck’s (2023) questioning of the willingness to consider feedback from residents that may conflict with their desired course of action, Kennedy (2023: 2) reminds us that “[a] democratic state cannot meaningfully confront catastrophic ecological decline with a divided public”.

One’s relationship to both the environment, and to dominant ideas of how to “properly” respond to climate change may impact how residents understand the urgency of combatting climate change. Such attitudes also impact how effective different framings of climate policies are. Amongst Canadians, different segments respond differently to how interventions are framed and narrativized (Martin-Morin and Lachapelle, 2022: 2). These segments include a spectrum from “Alarmed”, who believe “climate change is happening”, feel well-informed, and

believe that there is a need for significant government intervention; to the “dismissive” who believe that climate change is not happening, and are confident in this belief (Martin-Morin and Lachapelle, 2022: 9–10). Within the five segments, there are distinct differences in characteristics along gender lines, geographic lines, and political lines. For example, those who are “alarmed” tend to be (when compared to the national average) women, left-wing, and “more likely than average to express vote intentions for the Liberal Party of Canada or the Green Party of Canada” (10). Conversely, those within the “dismissive” segment are more likely to be men, live in Alberta (and are least likely to live in Quebec or Ontario), and have intentions to vote for the Conservative Party of Canada (10). Reaching out to such segments requires considering how messages are framed (e.g., in terms of relative costs, how investments are made, who is providing the message, and so on), as well as how to disseminate messaging in ways that are meaningful and thoughtful (Hatch et al., 2024; Martin-Morin and Lachapelle, 2022).

People living in different parts of Canada are going to have different relationships to climate change based on the prevalence of different energy sources (oil and gas, hydropower, nuclear, solar, etc.), their experiences with different economies (e.g., logistics, energy extraction, renewable developments), and how they relate to these energy sources and economies. Bush and Clayton (2022) in their study on the intersection of gender and attitudes of climate change mitigation found that citizens from wealthier countries (such as Canada and the United States) will “perceive fewer benefits and greater costs”, and that men perceive these costs as greater than women. This is consistent with Andre et al.’s (2023: 255) finding that “a country’s GDP per capita reflects its resilience, that is, its economic capacity to cope with climate change. Put differently, in countries that are most resilient, individuals are least willing to contribute 1% of their income to climate action.”

How might socio-demographic characteristics and the larger narrative frame of energy transition impact these trends? Recalling that the social and political facets of transportation are “hard-to-decarbonize”, it is valuable to reflect on the material and psychological costs of transition (Bush and Clayton, 2023; Buck, 2018). Men are more likely to be warehouse workers, associate their sense of identities with carbon-intensive industries (trucking, oil and gas extraction), and as such, be attuned to the perceived costs of energy transition along the lines of identity. Further, “in the case of the carbon tax, for example, the changes some individuals will have to make in terms of their jobs and lifestyles might cause them to

experience hardships in terms of losing a valued professional identity or form of expression" (Bush and Clayton, 2022: 597).

In light of these considerations, we ask one question related to proximity to infrastructure:

RQ4: Does place of residence and proximity to different kinds of infrastructure impact one's beliefs in how well different levels of government perform?

Attitudinal differences and beliefs across socio-demographic lines, geographic regions, and narratives beliefs makes finding common ground a necessary but complex exercise. One of the challenges is that residents have often been poorly engaged on planning matters in general, and there is often little public engagement related to freight infrastructure in spite of the historic siting of facilities and highways in disinvested and vulnerable communities (Fried et al., 2023). The seemingly technical and "a-political" nature of road freight may contribute to poor engagement with the public (Hall and Hesse, 2013). It is perceived that there is little public interest in road freight interventions and infrastructure until the resulting negative externalities become apparent (Fried et al., 2023, Department of Infrastructure and Regional Government, 2014; Hall and Hesse, 2013).

In light of the broader research on government trust and climate action, we ask:

RQ5: Do Canadians want greater levels of collaboration and cooperation between the Federal government, their provincial government, and their municipal/local governments on matters related to road freight and climate change?

3.3 Perceptions of Regional Freight Interventions and Policies

A key question to be addressed is which level of government should be accountable for the following interventions, discussed in both the literature and by public sector professionals outlined in Chapter 2. In the section that follows, we outline how accountabilities for each road freight intervention are distributed currently, and the prospective value of each intervention for road freight decarbonization. As many residents have little exposure to all the moving parts that go into the management of road freight, it is important to have a sense of what respondents thought of some of the critical elements, from coordinating industrial land uses, building code development, funding for green freight technology, and developing regional

governance mechanisms. See Table 3.1 Current Governance Model for Road Freight Interventions.

Table 3.1 Current Governance Model for Road Freight Interventions

Policies and Interventions	Current Governance Model
Coordinating new logistics centres and industrial parks (INFRA_47)	Municipally or Regionally Led Occasional Federal involvement based on investment and presence of rail and marine connections
Organizing regional agencies to coordinate transboundary transportation projects (INFRA_48)	Provincially Led
Supporting regional and national building standards for commercial and industrial construction (INFRA_49)	Municipally or Provincially Led Federal involvement in development of codes (national)
Integrating environmental data with zoning data (INFRA_50)	Municipally or Provincially Led
Funding and support for private sector ownership of electric delivery vehicles (INFRA_51)	Federally or Provincially Led
Funding and support for electric vehicle charging infrastructure on highways (INFRA_52)	Municipal, Provincial, and Federal contributions
Funding and support for private sector R&D in green freight vehicle technology (INFRA_53)	Municipal, Provincial, and Federal partnerships
Funding and support for academic R&D in green freight vehicle technology (INFRA_54)	Municipal, Provincial, and Federal partnerships
Funding for rail freight corridor expansions (INFRA_55)	Federally led
Funding expansions of highways and roads (INFRA_56)	Municipal, Regional, and Provincially Led

Coordinating new logistics centres and industrial parks. The placement of industrial land uses is overseen by municipal or regional governments via delegated powers from provincial governments. As such, the development of industrial parks is often spearheaded by municipalities as part of economic development strategies (Woudsma, 2013), where they own and service the land before selling lots to interested parties. Some municipalities will develop an industrial land use strategy or freight strategy that provides policy direction on where to place industrial land uses. However, “local governments cannot manage regional development trends independently” (Barnett, 2020: 34). As such, some jurisdictions in Ontario (Upper-Tier Municipalities), Quebec (MRCs), and Nova Scotia (the JRTA) also have an

additional layer of freight management at the regional scale that plans above the municipal level. Such management allows for more coherent regional planning that, just like transportation flows, transcends municipal boundaries (Barnett, 2020; Aderneck, 2023; Hall and Hesse, 2013). In instances where rail or marine freight are involved, there may also be federal involvement in the placement or management of industrial parks (Lawson, 2015).

Organizing regional agencies to coordinate transboundary transportation projects. Regional transportation agencies receive their authorities through provincial powers and legislation. For example, Ontario's Peel Region's powers come from the *Regional Municipality of Peel Act* (2005), and Nova Scotia's Joint Regional Transportation Agency's (JRTA) powers come from Bill 61, *Joint Regional Transportation Agency Act* (2021). The JRTA is a provincial crown corporation with a goal to achieve "efficient and sustainable goods movement" for a region that includes the Halifax Regional Municipality, 14 municipalities, and five First Nations (JRTA, 2024). Given the interconnection of transportation and land use, the benefit to region-wide freight management is the coordination and long-term planning of freight routes, multi-modal connections and transfers (between road, marine, and rail), and the placement of industrial land uses. Not only does this provide an opportunity to limit conflicts between different road uses through the placement and design of the transportation system, but it may also result in less competition between municipalities when developing industrial and business parks. However, a failure to adequately engage partner agencies and residents may result in a lack of social license to act, in spite of having legislated authority (OECD, 2019).

Supporting regional and national building standards for commercial and industrial construction. Canada currently has a national building code that covers commercial and industrial developments (see *National Building Code of Canada, 2020*). As a "model code", however, it does not hold any legal powers until a jurisdiction adopts it. New Brunswick and Nova Scotia have adopted Canada's national code, though the latter has stalled on updating the most recent version, which includes important improvements to building efficiency and fire protection—critical elements as the climate crisis advances (CBC, 2023). Quebec and Ontario have both adopted their own building codes that adopt critical elements from the national code with significant variations. Municipalities and regional governments may also adopt their own building codes and design guidelines for developments, though they must meet the requirements of all provincial and federally adopted standards. There are also voluntary standards such as LEED for commercial buildings.

Existing building codes and standards are often framed as minimum requirements to be met. As such, developments may be built that are compliant with all applicable codes but do not meaningfully commit to societal goals such as sustainability and net-zero development (de Graaf, 2023; Easterling, 2014). As such, there is a need to develop more prescriptive standards for developments that go beyond setting a minimum standard. As Rissman et al. (2020: 24) note in the case of material standards:

> Modernization of guidelines and codes is needed for acceptance of emerging technologies and materials in the built environment. For example, with concrete, there is some room within current codes to improve sustainability by reducing cement content, often through inclusion of supplementary cementitious materials. In contrast, current codes may hamper the use of alternative materials whose long-term behavior is less certain than that of conventional materials. Updated codes, combined with targets, labelling, and economic incentives for alternative materials, could facilitate the incorporation of these materials into buildings.

When different levels of government move to update or develop new codes and standards, there is an opportunity to be more prescriptive about the development of goods movement facilities.

Integrating environmental data with zoning data. Municipalities are primarily responsible for developing and maintaining zoning by-laws and land use designations. municipal, regional, and provincial governments collect environmental data categories such as watersheds, wetlands, and coastal areas (Bennett, 2020). Some regional governments are also responsible for land use planning (see Montreal's Communauté métropolitaine de Montréal or CMM). Natural assets often transcend local boundaries and benefit from regional or provincial monitoring and study. The close integration of provincial data and municipal data would allow for better decision-making that considers both local zoning and environmental concerns with regional and provincial ones. While much of this may already be accomplished in the way that planning documents are structured (e.g., official community plans and transportation plans must consider higher-level plans and strategies), explicitly coupling environmental and zoning data may help inform local and regional long-term planning of road freight assets. This may help identify where developments should and should not be placed, especially as many communities struggle with a greater prevalence of fire risks, flood risks, and more dangerous storms that could impact transportation routes and facilities. Better

environmental data may also make future infrastructure projects easier to complete, as there would then be existing knowledge on what conditions can be expected once construction begins (Levy, 2021).

Funding and support for private sector ownership of electric delivery vehicles. There are currently both federal (e.g., iMHZEV, ZEVIP, Green Freight Program) and provincial (e.g., Electrify Nova Scotia Rebate Program) incentive and subsidy programs in place to make the ownership of green fleet vehicles more viable for logistics and transportation firms. Municipalities occasionally run pilots for smaller green fleet vehicles in collaboration with private firms, though such programs focus on first/last mile deliveries, rather than longer-range goods movement (see, for example, Montreal's Colibri pilot and Toronto/Purolator's Mini-Hub pilot). As the private sector is the operator of regional and long-distance freight assets, the rationale is that providing incentives to decarbonize and transition to electric vehicles provide temporary market signals while mitigating the high initial cost of adopting new technologies (Harvey et al., 2018; Freidman et al., 2019). Assisting with the early uptake of electric fleets helps to lower the cost of such assets, removing the need for such subsidies as costs decline (Harvey et al., 2018; Rissman et al., 2020).

Funding and support for electric vehicle charging infrastructure on highways. A major barrier to road freight decarbonization is the current lack of charging and refueling infrastructure for long-haul trucks (Whitmore et al., 2023; Keyer-Bril, 2021). Municipal, provincial, and federal governments all currently contribute to supporting the expansion of charging networks, both through supportive policies (e.g., Halifax's 2020 *Municipal Electric Vehicle (EV) Strategy*), and through funding opportunities (e.g., the Federal Zero Emission Vehicle Infrastructure Program). As the primary owner and operator of charging infrastructure are private sector actors, funding opportunities are a form of "industry support programs" that could result in benefits to not just those who operate them, but other road-users (Neufeld and Massicotte, 2017: 22). The wide-spread availability of charging infrastructure could contribute to the wider adoption of electric delivery vehicles, while supportive policies from different levels of government can help direct the placement of charging infrastructure in ways that avoid conflicts with other users and land uses (see, for examples of such rationales for supportive policies in Halifax's *Municipal Electric Vehicle (EV) Strategy*).

Funding and support for private sector R&D in green freight vehicle technology and **Funding and support for academic R&D in green freight vehicle technology.** As discussed in the previous chapter, the public sector has a strong interest in collaborating with both academics and the private sector. On the one hand, the public sector and the academy have opportunities to collaborate on setting research agendas, as well as on developing new technological breakthroughs by using state-of-the-art research and development facilities (Harvey et al., 2018; Rissman et al., 2020; Noussan et al., 2020). On the other hand, there is interest in working with road freight operators, as they have on-the-ground expertise in goods movement, and have both facilities and fleets that can test out different policy and technological interventions (Rissman et al., 2020: 22). All levels of government are capable of partnering with academics and the private sector, whether it be to develop policies or setting research priorities (Harvey et al., 2018), or in testing out new technologies (Rissman et al., 2020).

Funding for rail freight corridor expansions. Modal shifts from road freight to rail freight are perhaps the most impactful way to reduce transportation emissions in Canada. Not only would such a modal shift reduce carbon emissions, but it would also reduce road wear-and-tear and congestion (Neufeld and Massicotte, 2017: 28). Canada's rail freight network is primarily governed by the Federal government in conjunction with CN and CP rail (Neufeld and Massicotte, 2017). Funding for such a modal shift can be direct, through programs to promote operators to shift, or indirectly through subsidies to mitigate higher upfront operational costs (Noussan et al., 2020). However, the viability of modal shifts is contingent on federal government investments into new rail infrastructure such as tracks and terminals.

Funding expansions of highways and roads. The responsibility for the maintenance and development of roads and highways is often divided between municipal, regional, and provincial governments, though to a driver they represent one-single transportation network (Lawson, 2015). The expansion of existing roads represents a "business-as-usual" approach to infrastructure development relative to other modes of transportation (see Handy 2023; Marx, 2022; Smart Growth America and Hattaway Communications, 2023; Marshall, 2021). We included this intervention in the options for respondents to consider in contrast to other policies that are more directly connected to a reduction in road freight emissions. The current federal Environment Minister, Steven Guilbeault, noted that there will no longer be larger investments in new road-infrastructure (such as Quebec City's Third Link project), instead

focusing federal investment on maintenance of existing infrastructure and non-automotive transportation infrastructure (Tasker, 2024). Given that the governance of roads and highways is divided across all levels of government, provincial and municipal agencies may still expand roadways, to accommodate passenger and commercial vehicles, though such investments are becoming less popular (Marshall, 2021; Kimble, 2024).

Such incentives may reduce the emissions from road freight, though they continue to operate under the assumption of a business as usual, growth-for-industry scenario that may see higher consumption that cannibalizes lower emissions (see Tortajada et al., 2022 for how increases in efficiency may result in rebounding effects that increase energy use).

In light of this previous work on road freight interventions, we posit two research questions:

RQ6: Do Canadian perceptions of who should be responsible for road freight interventions align with current government accountabilities?

RQ7: Do sociodemographic characteristics impact one's perceptions of what levels of government should be responsible for different interventions?

3.4 Study Design and Methods

This research is a cross-sectional study of Canadian opinions drawn from an online panel of participants in Ontario, Quebec, Nova Scotia, and New Brunswick. Surveys were distributed in English and in French by Dynata, a market research firm. Respondents who work for a federal agency, provincial government, or regional and local government were screened out of responding to the survey, in order to ensure participation only from respondents who do not have first-hand knowledge of how governments collaborate with each other. A quota-based sample of 304 respondents answered the survey between September 20 and 22, 2023. Quotas were balanced on key sociodemographic characteristics including province, age, gender, and language. This survey was approved by École de technologie supérieure's Comité d’éthique de la recherche (reference H20230305). Participant consent was informed.

In light of both the literature’s findings of people’s perceptions of trust in government and climate change, and the findings outlined in Chapter 2, this research presents an opportunity to better understand how Canadians perceive the performance of the bodies that govern them. Additionally, it is an opportunity to understand what Central and Eastern Canadians believe

are the appropriate levels of government that should be responsible for road freight decarbonization, a critically understudied area of the transportation system.

Participants were asked to respond to four phases of questions. These included:

1. Phase 1: Sociodemographic characteristics, including whether or not they live near highways, industrial parks, and energy infrastructure.

2. Phase 2: Questions regarding participant beliefs in global warming, and the perceived impact on themselves, their family, and their immediate community. Global warming was defined as the notion that average temperatures have been increasing globally for the past 150 years, and that this trend will continue into the future (see Marlon et al., 2023).

3. Phase 3: Questions about participant belief in the efficacy of their national, provincial, and local government to address global warming, and how well these levels of government collaborate with each other.

4. Phase 4: Questions about what levels of government should be responsible for 10 policy and programmatic interventions associated with road freight infrastructure decarbonization.

The complete survey may be found in *Appendix I: General Population Survey (English and French).*

Respondents were asked to provide their responses to prompts in Phases 2 and 3 using Likert scales that range from 1 (strongly disagree) to 5 (strongly agree). In Phase 4, respondents were asked to indicate whether they thought the federal government, their provincial government, or their local government should be responsible for the listed policy and programmatic interventions. In this Phase, respondents were able to select multiple levels of government, as well as to abstain from answering. At the request of our Ethics Committee, respondents were given the option to abstain from answering all questions on the survey (except for those that would disqualify ineligible participants).

Upon collection of the survey results, two levels of analyses were conducted. The first level of analysis considered survey responses to phases 1, 2, and 3. Respondent survey data was

reduced and coded. This included simplifying sociodemographic categories such as age and income. Then, using IBM SPSS Statistics (v. 29), a hierarchical cluster analysis using average linkage (between groups) was undertaken to determine which participant responses were grouped together. The dendrogram is included in Figure 3.1 Dendrogram**Error! Reference source not found.** Cluster analysis is a means of classifying groups of items that have a high degree of similarity into homogenous groups. Aldenderfer and Blashfield (1984) recommend cluster analysis as a way to compute average similarity to all cases within the cluster before joining the cases to the cluster if and when there is a sufficient likeness to other cases. Norusis (2011: 373) further notes that “this method combines clusters so that the average distance between all cases in the resulting cluster is as small as possible”. There were six resulting clusters: (1) Global Warming Effects, (2) Future Government Cooperation, (3) Government Awareness Level, (4) Trust, (5) Current Government Cooperation, and (6) Government Effort. Both the overall cluster and individual survey prompts within each cluster were then compared to the descriptive statistics responses.

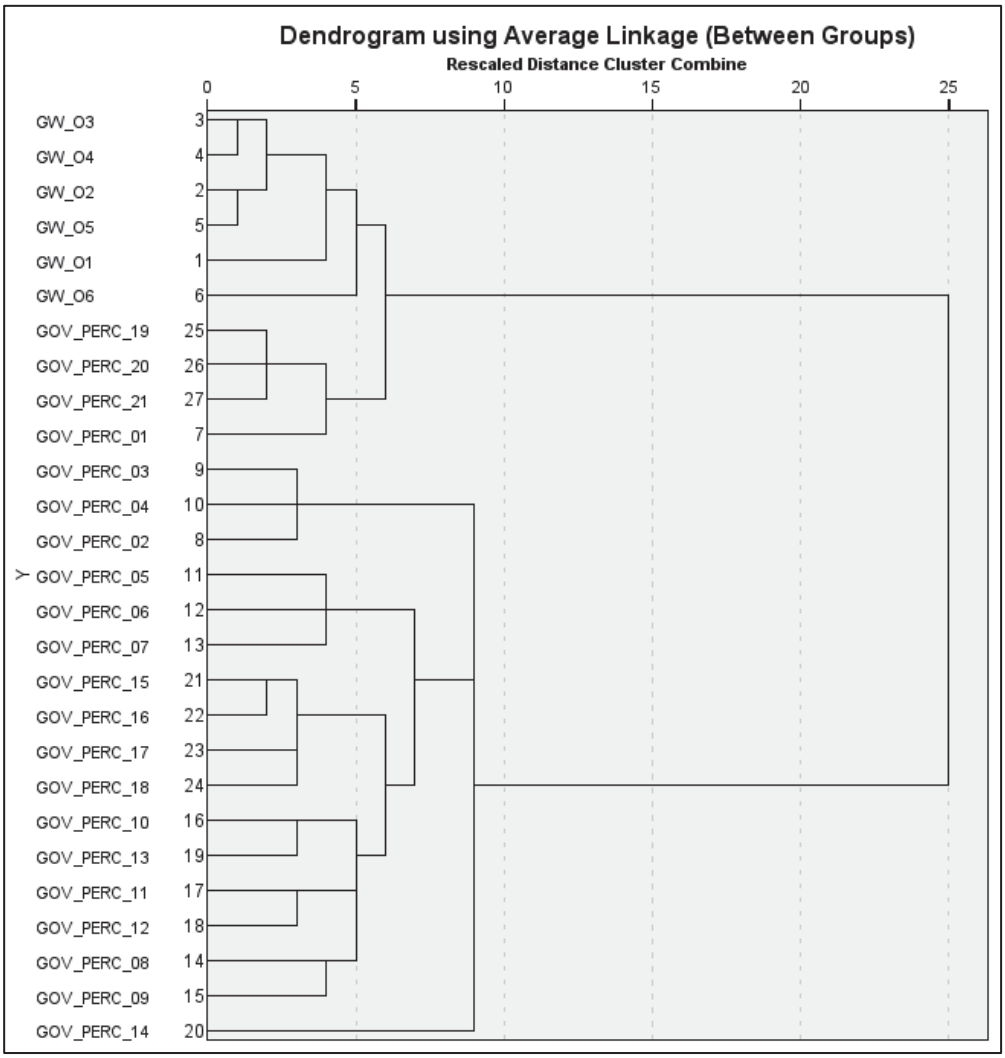

Figure 3.1 Dendrogram

The second level of analysis looked at participant responses to Phases 1 and 4. Respondent survey data was reduced and coded, with each prompt being divided into three sub-questions. For instance, in being asked to identify who respondents believe should be responsible for interventions, the responses to prompt 47: “The coordination of where to allow new logistics centres and industrial parks to be sited and constructed”, was broken down into 47.1 (Federal responsibility), 47.2 (Provincial responsibility), and 47.3 (Municipal responsibility). Sub-responses .1, .2, and .3 were then coded using 0 and 1 to represent yes or no in the belief that that level of government should be responsible. These sub-responses were then compared to the descriptive statistic responses.

3.5 Findings: Analysis 1 - Descriptive Analysis

As mentioned above, our analysis identified six clusters. We describe below all results that are significant or partially significant. The decision to include partially significant results stems from the novelty of this research and the value that these findings may provide to policy makers and planners and engineers in the public sector. Pritschet et al. (2016), in a study of over 1,500 papers in three psychology journals, found that terms such as “approaching significance” and “marginally significant” were used for p-values between 0.05 and 0.1. Amrhein et al. (2017: 27) note the importance of reporting both significant and “partially significant” results over .05, as “applying significance thresholds leads to overconfidence in small but highly variable p-values, to conclusions that are based on inflated effects, and to publication bias against larger p-values” while “larger p-values are to be expected also if there is a true effect, and they must be published because otherwise smaller p-values are uninterpretable”.

Cluster 1: Global Warming Effects involved prompts concerning the harms of global warming that were perceived to have impacted respondents. This included harm to those in one’s geographic community, to the respondents and their immediate family, and to Canadians more broadly. This cluster somewhat agreed with the sentiment that the effects of global warming are already being felt by themselves, their families, and their communities, and that they are already experiencing the effects of global warming. See: Table 3.2 Cluster 1: Global Warming Effects for a breakdown of significant and partially significant results.

Table 3.2 Cluster 1: Global Warming Effects[5]

Cluster 1: Global Warming Effects (Somewhat Agree)	Pearson Chi-Square	Degrees of Freedom	P-Value
Global Warming Effects & Age	18.804	8	0.016
Global warming will harm people in my geographic community (GW_03) & Age	18.608	8	0.017
Global warming will harm people in my geographic community (GW_03) & Proximity Energy	27.134	12	0.007
Global warming will harm people in my geographic community (GW_03) & Proximity Highway	14.3	8	0.074
Global warming will harm me and/or my family members (GW_O4) & Proximity Highway	22.178	8	0.005
Global warming is already harming Canadians (GW_O5) & Proximity Industry	16.736	8	0.033
Global warming is already harming Canadians (GW_O5) & Proximity Energy	13.645	8	0.092
Global warming is already harming Canadians (GW_O5) & Proximity Highway	20.041	8	0.01
I have already experienced the effects of global warming (GW_O6) & Education	44.413	28	0.025
I have already experienced the effects of global warming (GW_O6) & Proximity Energy	27.902	12	0.006

For the Global Warming Effects cluster, age (p = .016) was a significant socio-demographic characteristic, with respondents between 18 and 35 (35.7%) and 36 and 55 (41.2%) more likely to believe that global warming has negatively impacted themselves, their families, their communities and other Canadians. In contrast, only 23% of Canadians over 56 believed that they were harmed by global warming. Education (p = .025) was found to have a significant relationship for “I have already experienced the effects of global warming”: 28% of respondents with bachelor’s degrees believed that they had already experienced the effects of global warming, and 20% of respondents who completed secondary/high school believed they had already experienced the effects of global warming. 19.3% of respondents who completed technical or community college believed the same. Those who did not complete high school (6%), completed some technical college (10%), or completed some university education (5.3%) were less likely to believe that they had experienced some of the effects of global warming.

Within Cluster 1, the characteristics that were most likely to impact one’s belief that global warming impacted themselves, their community, or family members were proximity to energy infrastructure, proximity to highways, and proximity to industrial parks.

For proximity to energy infrastructure, respondents were more likely to believe that global warming was harming members of their community (p = .007), with respondents who did not

[5] Green represents significant results, and orange represents partially significant results.

live near energy infrastructure (52.5%) being more likely than those who did (34.6%) to believe that their communities were harmed by global warming. Moreover, those respondents who did not live near energy infrastructure (52.5%) were more likely to believe that global warming was already harming Canadians ($p = .092$) compared to those that lived near energy infrastructure (34.9%). Respondents who did not live near energy infrastructure (52.3%) were also more likely to believe that they had experienced the effects of global warming, compared to those that lived near energy infrastructure (34.8%).

For proximity to highways, respondents who lived near highways were more likely to believe that global warming had harmed themselves or their families (86.8%), compared to those who did not live within 10 minutes of a highway (11.6%) ($p = .005$). Moreover, respondents who lived near highways (86.8%) believed that global warming was already harming Canadians compared to those who did not live near highways (11.9%) ($p = .001$).

Finally, respondents who lived near industrial or business parks were more likely to believe that global warming is already harming Canadians (69.2%) compared to those who did not live near industrial parks.

Cluster 2: Future Government Cooperation included prompts about the desire to see greater cooperation between the federal, provincial, and municipal governments in addressing global warming. Two prompts in this cluster also included broader queries about seeing all levels of government acting to implement laws and programs that consider the environment. Respondents in this cluster somewhat agreed that greater cooperation was desirable between the federal and provincial governments, federal and local governments, and provincial and local governments. See Table 3.3 Cluster 2: Future Government Cooperation.

Table 3.3 Cluster 2: Future Government Cooperation[6]

Cluster 2, Future Government Cooperation (Somewhat Agree)	Pearson Chi-Square	Degrees of Freedom	P-Value
Future Government Cooperation & Area Lived	18.69	12	0.096
Future Government Cooperation & Proximity Highway	23.91	8	0.002
I would like to see greater cooperation between the federal and provincial government in addressing global warming (GOV_PERC_19) & Gender	19.255	12	0.083
I would like to see greater cooperation between the federal and provincial government in addressing global warming (GOV_PERC_19) & Proximity Highway	16.023	8	0.042
I would like to see greater cooperation between the federal government and my local government in addressing global warming (GOV_PERC_20) & Proximity Industry	13.451	8	0.097
I would like to see greater cooperation between the provincial government and my local government in addressing global warming (GOV_PERC_21) & Proximity Industry	21.226	8	0.007
All levels of government should act and implement laws and programs that take the environment into consideration (GOV_PERC_01) & Age	16.731	8	0.033
All levels of government should act and implement laws and programs that take the environment into consideration (GOV_PERC_01) & Education	49.444	28	0.007

For the Future Government Cooperation cluster, the area one lived in (p. = .096) and proximity to highways (p = .002) were partially significant and significant characteristics, respectively. Respondents who lived in urban areas (49.8%) were more likely to want to see greater cooperation between different levels of government compared to those who lived in rural areas (15.5%) or suburban areas (34.4%). Respondents who lived near highways (86.6%) were more likely to want to see greater cooperation between different levels of government, compared to those who did not (12.0%).

Within Cluster 2, gender, age, and education were socio-demographic characteristics that were significant or partially significant. Men and women were equally likely to want to see greater cooperation between the federal and provincial government in addressing global warming at 50.2% and 48.1%, respectively (p = .083). Respondents between 36 and 55 (40.5%) were more likely than those who were 18 to 35 (34.9%) or those who were older (24.34%) to want to see all levels of government act and implement laws and programs that consider the environment (p = .033). Respondents with bachelor's degrees (28.2%) and those who completed secondary school (20.5%) were most likely to want to see all levels of government act and implement laws and programs that consider the environment (p = .007).

Respondents who lived near highways, industrial parks, and logistics facilities were also more likely to want to see greater cooperation between different levels of government. Respondents

[6] Green represents significant results, and orange represents partially significant results.

who lived near highways (86.8%) were more likely to want to see greater collaboration between the federal and provincial government in addressing global warming ($p = .042$). Respondents who lived within 20 minutes of an industrial park (69.2%) were more likely to want to see greater cooperation between the federal government and their local government to address global warming ($p = .097$), as well as greater collaboration between their provincial and local governments ($p = .007$) than those who did not (20.1%).

In light of the above findings, we can positively answer *RQ5*, noting that younger Canadians and middle-aged Canadians are more likely to want to see greater cooperation between federal, provincial, and municipal governments in addressing climate change. We also note that across distinct governance relationships (e.g., provincial-local, federal-provincial) there is a desire to see greater cooperation along different demographic characteristics, such as education, gender, and proximity to highways and industrial parks.

Cluster 3: Government Awareness Level included prompts gauging respondent's level of knowledge about what actions the federal, provincial, and municipal governments undertake to combat climate change. Respondents in this cluster felt neutral about their knowledge of climate change interventions. We understand this to mean that they felt neither well informed nor lacking in their knowledge of what their respective levels of governments are involved in.

See Table 3.4 Cluster 3: Government Awareness Level for a breakdown of significant and partially significant results.

Table 3.4 Cluster 3: Government Awareness Level[7]

Cluster 3, Government Awareness Level (Neutral)	Pearson Chi-Square	Degrees of Freedom	P-Value
Government Awareness Level & Gender	19.264	12	0.082
Government Awareness Level & Education	44.378	28	0.025
Government Awareness Level & Proximity Industry	16.688	8	0.034
I feel well informed about what actions my provincial government is taking to combat global warming (GOV_PERC_03) & Gender	20.516	12	0.058
I feel well informed about what actions my provincial government is taking to combat global warming (GOV_PERC_03) & Education	43.4	28	0.032
I feel well informed about what actions my provincial government is taking to combat global warming (GOV_PERC_03) & Proximity Industry	22.543	8	0.004
I feel well informed about what actions the federal government is taking to combat global warming (GOV_PERC_02) & Age	18.503	8	0.018
I feel well informed about what actions the federal government is taking to combat global warming (GOV_PERC_02) & Gender	18.889	12	0.091
I feel well informed about what actions the federal government is taking to combat global warming (GOV_PERC_02) & Education	46.169	28	0.017

For the Government Awareness Level cluster, gender was a partially significant characteristic (p = .082), while education (p = .025) and one's proximity to industry (p = .034) were found to be significant. Men (50%) and women (47.9%) both felt neutral about their overall knowledge of what actions their different levels of government are taking to combat global warming. Across different educational levels, respondents who completed a bachelor's degree (28.5%), those who completed secondary education (19.4%), and those who completed community college or technical college (19.4%) were most likely to be neutral about their level of knowledge in what actions their different levels of government are taking to combat global warming. Respondents who did not live near energy infrastructure (52.8%) were more likely than those who did (35.2%) to feel neutral about their knowledge of what actions their different levels of government are taking to combat global warming.

Within Cluster 3, age, gender, and education were socio-demographic characteristics that were significant or partially significant. Respondents between 36 and 55 (41.2%) were most likely to feel neutral about how well informed they are about what actions the federal

[7] Green represents significant results, and orange represents partially significant results.

government is taking to combat global warming, compared to 34.8% of respondents between 18 and 35 (34.8%), and those who were over 60 (24%) (p = .018). Men (50.3%) and women (47.6%) both felt neutral about their knowledge of what actions provincial governments are taking to tackle climate change (p = .058). Men (50.2%) and women (47.8%) also generally felt neutral about their knowledge of federal actions (p = .091). Respondents who completed a bachelor's degree (28.6%), those who completed secondary school (19.7%) and those who completed technical college (19.0%) were most likely to feel neutral in their knowledge of what their provincial government is doing to tackle global warming (p = .032). Similarly, the same educational cohorts also felt neutral in their knowledge of federal actions to tackle global warming (p = .017).

Respondents who lived near an industrial park (69.0%) were more likely to feel neutral about their knowledge of what their provincial government is doing to tackle global warming compared to those who do not live near an industrial park (20.2%) (p = .004).

Cluster 4: Trust included prompts gauging whether or not respondents believed that the federal, provincial, and local governments follow through on their actions (e.g., passing laws, investing in communities, etc.). Respondents somewhat disagreed that different levels of government followed through on their stated actions. See Table 3.5 Cluster 4: Trust for a breakdown of significant and partially significant results.

Table 3.5 Cluster 4: Trust[8]

Cluster 4, Trust (Somewhat disagree)	Pearson Chi-Square	Degrees of Freedom	P-Value
Trust & Province	20.479	12	0.059
When my provincial government says it will do something (e.g., pass laws, invest in my community, etc.), I am confident they will follow through (GOV_PERC_06) & Province	21.816	12	0.04
When my provincial government says it will do something (e.g., pass laws, invest in my community, etc.), I am confident they will follow through (GOV_PERC_06) & Proximity Industry	13.489	8	0.096
When my local government says it will do something (e.g., pass by-laws, invest in the community, etc.), I am confident they will follow through (GOV_PERC_07) & Age	15.106	8	0.057
When my local government says it will do something (e.g., pass by-laws, invest in the community, etc.), I am confident they will follow through (GOV_PERC_07) & Proximity Energy	21.297	12	0.046

For the Trust cluster, one's province of residence was found to be a partially significant characteristic (p = .059). Respondents from Ontario (45.5%) somewhat disagreed that they

[8] Green represents significant results, and orange represents partially significant results

trusted the federal, provincial, or municipal levels of government to follow through on actions such passing laws, investing in their communities, while Quebecers (39.8%), New Brunswickers (6.7%), and Nova Scotians (7.89%) were less likely to believe their governments did not follow through on their stated actions. Moreover, 45.4% of respondents from Ontario somewhat disagreed that they trusted their provincial government to follow-through on actions such as passing laws and investing in their community, while Quebecers (39.8%), New Brunswickers (7%), and Nova Scotians (7.9%) were less likely to believe that their provincial governments could not be trusted to follow through on actions ($p = .04$).

Within Cluster 4, age was a partially significant characteristic ($p = .057$), with respondents between 36 and 55 (41.1%) being the most likely to somewhat disagree that they could trust their local government to follow through on their stated actions, followed by respondents between 18 and 35 years old (34.4%). Respondents over 60 (24.5%) were least likely to disagree that the government could be trusted to follow through on their actions. Other characteristics of significance or partial significance included proximity to industry ($p = .096$), and proximity to energy ($p = .046$). Respondents who lived near industrial parks (68.9%) somewhat disagree that they trust their provincial government to follow through in their stated actions, while respondents who did not live near industrial parks (19.9%) somewhat disagree. Respondents who did not live near energy infrastructure (52.5%) were more likely to believe that their local government could not be trusted to follow through on their stated actions compared to those who did live near energy infrastructure (34.6%).

In light of the findings for Cluster 3 and 4, we positively answer both *RQ1 and RQ3.* We note that respondents did not feel as though they had a strong knowledge base of what actions different levels of government are taking to combat global warming, and that they generally have a low level of trust in their respective levels of government. Middle aged and younger Canadians were most likely to believe that municipal governments could not be trusted to follow through on stated actions (*RQ1*). Additionally, there were variations in degrees of trust in government across provinces, with Ontarians and Quebecers being the most likely to believe that their governments would not follow-through on stated actions (*RQ3*). There was no significant relationship found between trust in government and gender (*RQ2*).

Cluster 5: Current Government Cooperation included prompts gauging whether or not respondents believed there to be good collaboration on global warming between the federal,

provincial, and municipal governments. Respondents somewhat disagreed that there was good collaboration between the different levels of government. See Table 3.6 Cluster 5: Current Government Cooperation for a breakdown of significant and partially significant results.

Table 3.6 Cluster 5: Current Government Cooperation[9]

Cluster 5, Current Government Cooperation (Somewhat disagree)	Pearson Chi-Square	Degrees of Freedom	P-Value
Current Government Cooperation & Age	16.151	8	0.04
The federal and provincial government work well together to address global warming (GOV_PERC_15) & Gender	19.408	12	0.079
The federal and provincial government work well together to address global warming (GOV_PERC_15) & Education	43.627	28	0.03
The provincial government and my local government work well together to address global warming (GOV_PERC_16) & Age	29.513	8	<.001
The provincial government and my local government work well together to address global warming (GOV_PERC_16) & Education	46.079	28	0.017
The federal government provides adequate support to my local government in addressing global warming (GOV_PERC_17) & Age	15.159	8	0.056
The federal government provides adequate support to my local government in addressing global warming (GOV_PERC_17) & Proximity Industry	13.527	8	0.095
The federal government provides adequate support to my local government in addressing global warming (GOV_PERC_17) & Proximity Highway	16.709	8	0.033
The provincial government provides adequate support to my local government in addressing global warming (GOV_PERC_18) & Age	15.378	8	0.052

For the Current Government Cooperation cluster, age was a significant socio-demographic characteristic (p = .04). Respondents between 36 and 55 (40.5%) were the most likely to disagree that the different levels of Canadian government work well together in addressing global warming, followed by those between 18 and 35 (35.3%), and finally, those over 60 (24.2%).

Within Cluster 5, gender, education, and age were found to be significant or partially significant socio-demographic characteristics. Men (50.5%) and women (47.5%) both somewhat disagreed that the federal and their provincial government work well together on addressing global warming (p = .079). When considering age, respondents between 36 and 55 (40.5%) were the most likely to disagree that their local government and provincial governments work well together in addressing global warming, followed by those between 18 and 35 (35.1%), and finally, those over 60 (24.3%) (p = <.001). Similar distributions were found across age groups concerning the perceived adequacy of support provided by federal (p = .056) and provincial governments (p = .052) to local governments to address climate change. Across educational cohorts, respondents with bachelor's degrees (28.3%), those who completed high

[9] Green represents significant results, and orange represents partially significant results.

school (20.1%), and those who completed technical college (19.1%) all somewhat disagreed that their local and provincial governments work well together in addressing global warming ($p = .017$). Similar distributions across educational cohorts were also observed for collaboration between the federal government and respondent's local governments ($p = .03$).

Proximity to highway ($p = .033$) and to industrial parks ($p = .095$) were two characteristics that were also of note in Cluster 5. Respondents who lived near industrial parks (69.6%) were more likely to somewhat disagree with the statement that the federal government provides adequate support to their local government in addressing global warming, compared to those who do not live near industrial parks (19.9%). Finally, Respondents who lived near highways (87.2%) were more likely to somewhat disagree with the statement that the federal government provides adequate support to their local government in addressing global warming, compared to those who did not live near highways (11.5%).

Cluster 6: Government Effort included prompts gauging whether or not respondents believed that different levels of government are doing all that they can within their powers to combat global warming. Other prompts included those querying whether or not respondents believed adequate financial support and the right tools to combat global warming were provided to communities. Respondents somewhat disagreed that their governments were doing all that they can to combat global warming. See Table 3.7 Cluster 6: Future Government Cooperation for a breakdown of significant and partially significant results.

Table 3.7 Cluster 6: Future Government Cooperation[10]

Cluster 6, Government Effort (Somewhat disagree)	Pearson Chi-Square	Degrees of Freedom	P-Value
Government Effort & Proximity Highway	18.629	8	0.017
The federal government is doing all that it can to combat global warming (GOV_PERC_08) & Proximity Industry	15.056	8	0.058
My provincial government is doing all that it can to combat global warming (GOV_PERC_09) & Proximity Industry	27.258	8	<.001
My local government is doing all that it can to combat global warming (GOV_PERC_10) & Gender	21.933	12	0.038
My local government is doing all that it can to combat global warming (GOV_PERC_10) & Province	18.656	12	0.097
The provincial government provides adequate financial support to my community to combat global warming (GOV_PERC_12) & Age	13.993	8	0.082
My local government responds appropriately to the challenges facing my community, including climate change (GOV_PERC_13) & Proximity Industry	16.157	8	0.04
I believe my local government has all the tools needed to address global warming (GOV_PERC_14) & Age	23.158	8	0.003
I believe my local government has all the tools needed to address global warming (GOV_PERC_14) & Gender	19.152	12	0.085
I believe my local government has all the tools needed to address global warming (GOV_PERC_14) & Province	20.75	12	0.054

For the Government Effort cluster, proximity to highways was found to be a significant characteristic (p = .017). Respondents who lived near highways were more likely to somewhat disagree that the different levels of Canadian government were doing all that they can to combat global warming (86.0%) compared to those who did not live near highways (12.8%).

Within Cluster 6, age, gender, and province of residents were found to be significant or partially significant socio-demographic characteristics. Respondents between 36 and 55 (40.4%) were most likely to somewhat disagree that their provincial government adequately supports their community in combatting global warming, followed by respondents between 18 and 35 (35%) and those over 60 (24.6%) (p = .082). Additionally, respondents between 36 and 55 (40.2%) were most likely to somewhat disagree that their local government has all the requisite tools to address global warming, followed by respondents between 18 and 35 (35.1%) and those over 60 (24.7%) (p = .003).

Men (50.0%) and women (47.6%) both somewhat disagree that their local government is doing all that it can to combat global warming (p = .038). Both men (49.8%) and women (48.1%) also somewhat disagreed that their local government has all the requisite tools to address global warming (p = .085).

[10] Green represents significant results, and orange represents partially significant results.

Respondents from Ontario (45.1%) were most likely to somewhat disagree that their local government is doing all that it can to combat global warming, followed by respondents from Quebec (39.7%), Nova Scotia (8.1%), and finally New Brunswick (7.1%) (p = .097). Ontarians (45.3%) were the most likely to somewhat disagree that their local governments have all the tools needed to address global warming, followed by Quebecers (39.9%), Nova Scotians (7.8%), and New Brunswickers (7.1%) (p = .054).

Proximity to industry was found to be a key characteristic. People who live near industrial parks (69.1%) were more likely to somewhat disagree that their provincial government is doing all that it can to combat global warming compared to those who did not live near industrial parks (19.5%) (p = <.001). This distribution was consistent when considering the responses of the federal government (p = .058) as well. Finally, people who live near industrial parks (69.2%) were more likely to somewhat disagree that their provincial government is adequately supporting their local community in the challenges that they face compared to those who did not live near industrial parks (20.3%) (p = .04).

In light of the findings of Clusters 5 and 6, we affirm *RQ4*. Place of residence vis-a-vis proximity to industry, and proximity to highways, as well as across different provincial lines has a significant or partially significant impact on respondent perceptions of current government efforts to combat climate change in their current degrees of collaboration with other government actors, and in their capacity and available tools to combat global warming.

3.6 Discussion 1: Sociodemographic Characteristics and Public Perceptions of Climate Action

A number of sociodemographic characteristics were found to have significant and partially significant relationships to perceptions of trust in government, government effort, government cooperation, and belief in global warming. We discuss each relevant characteristic below. See Table 3.8 Clusters and Sociodemographic Characteristics for a breakdown of how the findings were distributed across clusters.

Table 3.8 Clusters and Sociodemographic Characteristics

	Age	Province	Area Lived	Gender	Education	Proximity Energy Infrastructure	Proximity Highways	Proximity Industrial Parks
Global Warming Effects	x				x	x	x	x
Future Government Cooperation	x		x	x	x		x	x
Government Awareness Levels	x			x	x			x
Trust	x	x				x		x
Current Government Cooperation	x			x	x		x	x
Government Effort	x	x		x				x

Age. Age was found to be significant or partially significant within each of the six clusters. Across each cluster, respondents between 36 and 55 were found to lead in concern for global warming, lack of trust in government, and in their desire to see better cooperation and future efforts from all levels of government. This age cohort was followed by respondents between 18 and 34, and finally, by those who were over 65. This is generally consistent with research that finds that there is high concern for global warming amongst youth (Malm, 2021; Hatch et al., 2024). This finding may suggest that current approaches to climate governance are not working in the eyes of younger generations (Malm, 2021; Dupuis-Déri, 2021). Widespread youth protests demanding government action have been growing both in Canada and globally, with one key demand being greater government action to mitigate the negative consequences of climate change (Malm, 2021; Meaker, 2024). This speaks to both a desire for the prioritization of climate change as an issue to be addressed, and a desire for greater government intervention.

Province. One's province of residence was found to be partially significant with Cluster 4 (Trust) and within Cluster 6 (Government Effort). As a baseline, concern over climate change is high across Ontario, Quebec, and the Atlantic provinces (Hatch et al., 2024). Ontarians were the least likely to trust their governments to follow through, and to believe that their governments are doing all that they can to combat climate change, followed by Quebec, New Brunswick, and Nova Scotia. This is at odds with research that shows that Quebecers and Ontarians are more likely to trust their government institutions (Statistics Canada, 2024). One explanation for this trend may be that there is a perception that governments do not follow through on their climate commitments, leading to lower degrees of trust when speaking about the climate specifically. For example, in Quebec, "71 percent of the population feel we have to accelerate the pace of climate action and 85 percent wish that governments, companies and individuals would undertake profound changes" (Hatch et al., 21). Trust may also be diminished by successive controversies involving provincial governments, such as Ontario's Ford government's now-scrapped plans to develop the greenbelt (Canadian Press, 2023),

and Nova Scotia's decision not to implement cross-partisan coastal protection regulations (Gorman, 2024). Low belief in the efficacy of current government action may also result from wider public discussions about the competencies of the public sector.

As the effects of climate change intensify, the demands on all levels of government to respond will require more resources, expertise, and funding—factors that are in short supply across Canada (see MacLean, 2019 on the lack of climate funding and expertise).

Area Lived. One's lived area—urban, suburban, or rural—was found to be partially significantly related to one's belief that there should be greater cooperation between different levels of government. Urban residents were the most likely to want to see greater public sector cooperation, followed by suburban, and then rural residents. While multi-jurisdictional systems such as transportation are present regardless of urban morphology and density, urban environments are unique in that they have a significant overlap of municipal, provincial, and federal actors working together (Chachra, 2023). The density of infrastructure and networks results in higher frequency of projects that require cooperation between public actors. Examples of issues and projects that are multi-level and multi-stakeholder include housing and homelessness, mass transit, and land development (e.g., ports redevelopments, inland ports and industrial parks) (Suttor, 2016; Bherer and Hamel, 2012; Hutton, 2012). When a project or issue crosses jurisdictional lines, residents may see tensions and the failure to collaborate that occurs between different levels of government, making it clear why greater public sector cooperation is needed. This is not to say that multi-stakeholder governance challenges do not arise in suburban or rural environments (Rossler, 2024; Lucas et al., 2021; Finbow, 2012). Rather, the *density* of these challenges in urban environments may result in the greater visibility of conflict and failure and heighten the need for smooth public sector collaboration. This in turn results in a desire for greater collaboration between actors.

Gender. Gender was found to be significant or partially significant across Cluster 2 (Future Government Cooperation), Cluster 3 (Government Awareness Levels), Cluster 5 (Current Government Cooperation), and Cluster 6 (Trust). Across each relevant cluster, men and women were found to be equally in agreement or disagreement on key issues. For example, men and women both somewhat disagree that local governments were doing all that they can to combat global warming, or that they had the necessary tools. Both also wanted to see greater collaboration between different levels of government.

This is at odds with existing literature which notes that there is generally a discrepancy between how men and women perceive the risks of climate change and the consequences of climate policy. Bush and Clayton (2022, 599) note that women are more likely to believe that climate action is necessary in spite of its costs, while men perceive the risks to mitigation to have greater psychological consequences. In other words, it is expected that men will perceive greater negative psychological costs to the climate transition, given occupational backgrounds in energy sectors, personal interests, and lifestyle choices that emit more carbon (Bush and Clayton, 2022: 601). Given that Central and Eastern Canada already have a high level of belief in the need for greater climate action, and in the urgency of the climate crisis (Hatch et al., 2024), it may be the case that such a difference in the perceived costs between men and women is diminished. Moreover, narratives around energy transitions and climate action may vary from province to province, as will their relationship to the necessity of carbon-intensive industries (see Marshall et al., 2018 for narratives in Alberta, and Hatch et al., 2024 for Quebec narratives). As Ontario, Quebec, New Brunswick, and Nova Scotia have a low concentration of Canada's energy sector jobs (11%)[11] (Natural Resource Canada, 2023), it may also be the case that there is a lack of a strong gender difference in perceptions of the costs of climate transition.

Education. Level of educational attainment was found to have a significant or partially significant relationship to Cluster 1 (Global Warming Effects), Cluster 2 (Future Government Cooperation), Cluster 3 (Government Awareness Level), and Cluster 5 (Current Government Cooperation). Overall, respondents with bachelor's degrees were more likely than those with a technical degree, high school diploma, or incomplete schooling to believe that they had been impacted by the consequences of global warming, that governments should cooperate more and provide better supports to each other on climate action, while feeling overall neutral about their current knowledge of what actions governments are undertaking. This is consistent with findings that education is related to audience segmentation on climate change: greater degree of educational attainment was found to be related to greater degree of concern for climate change (Martel-Morin and Lachapelle, 2022). It may follow that a greater concern for climate change would result in a desire for action on the part of governments to mitigate negative consequences (Hatch et al., 2024), and in turn, more collaboration between agencies.

[11] For comparison, Alberta, where one may expect the narrative "power" of oil and gas to be stronger, has 22% of Canada's energy sector jobs alone (National Resource Canada, 2023).

Proximity to Energy Infrastructure. One's proximity to energy infrastructure was found to have significant and partially significant relationships with Cluster 1 (Global Warming Effects) and Cluster 4 (Trust). For both clusters, *not living* near energy infrastructure was related to belief in the harms of global warming, as well as a lower degree of trust in government to follow through on stated actions. If we consider the roles that energy narratives play in how we understand our relationship to infrastructure (Chachra, 2023), it may be the case that living near energy infrastructure provides one with first-hand exposure to the "successful" follow-through of government action. Conversely, the failure to engage on the placement of energy infrastructure can also result in a loss of trust in government actors (see Hughes, 2021). Further research should explore how and why proximity to infrastructure impacts perceptions of government competence.

Proximity to Highways. One's proximity to highways was found to have a significant or partially significant relationship with Cluster 1 (Global Warming Effects), Cluster 2 (Future Government Cooperation), and Cluster 5 (Current Government Cooperation). Respondents who lived near highways were more likely than those who did not to believe that climate change was harming them or their families, as well as already harming other Canadians. Moreover, respondents who lived near highways also believed that better cooperation between public actors was needed in the future, as well as improved supports for different government actors today. Living near highways exposes residents to health problems that include strokes, birth defects, and lung disease (Samuels and Freemark, 2022), and exposure to "elevated levels of ultrafine particulates (UFP), black carbon (BC), oxides of nitrogen (NOx) and carbon monoxide (CO)" (Brugge et al., 2007). Additional nuisances include ongoing noise, congestion, and related dangers to high frequencies of motor vehicles nearby. As such, it follows that residents who live near highways may be exposed to greater health risks, and in turn, concerns with the externalities associated with highways. Respondents may perceive better cooperation between governments as one pathway to addressing some of the environmental concerns that arise from being in proximity to highways. Future qualitative research would be beneficial to explore the perceptions of residents who live near highways, and how this impacts their beliefs in government policy responses to pollution and congestion (see Nazam et al., 2021). Future research may also consider how residents balance the desire for perceived efficient and convenient private vehicle travel with the health and environmental risks associated with

expanding Canada's road network (see Zhu et al., 2019 for similar work on the link between risk perceptions and willingness to mitigate the effects of smog).

Proximity to Industrial Parks and Logistics Facilities. One's proximity to industrial parks and logistics facilities was found to have significant or partially significant relationships within all six clusters. Respondents who lived near industrial parks noted that they believe global warming is already harming them, and that they want to see better current and future cooperation between government actors. They also have lower levels of trust in governments to follow-through and believe that governments could be doing more to combat global warming. Similar to respondents who live near highways, proximity to industrial parks and logistics facilities may result in negative health effects (García-Pérez et al., 2020; Al-Wahaibi and Zeka, 2015; Brender et al., 2011). As such, being near facilities that increase one's health risks may result in a perception that better cooperation between levels of government may result in solutions that mitigate these risks.

Three sociodemographic characteristics that did not have any significant or partially significant relationships are income, employment status, and ethnicity. This is at odds with research that draws a link between income, employment status, and trust in government (Jesuit, 2014). Moreover, Bush and Clayton (2022) argue that economic development is closely related to the perceived costs of mitigating climate change, which may impact resident perceptions of the value of government interventions. As such, further research would be valuable to identify if and how income and employment may be related to trust in government, especially as Canada's cost of living crisis worsens.

Much of the planning literature argues that neighbourhoods with high concentration of low-income populations and communities of colour tend to have worse health outcomes, have greater exposure to noxious industrial operations, and have lower rates of investment in community development (Agyeman, 2014; Fried et al., 2023; Pellow, 2016; Scott, 2014; Agyeman et al., 2009; Waldron, 2020). As such, one may expect to see a negative relationship between ethnicity and trust in government given the legacy of environmental racism. That this analysis did not find a significant or partially significant relationships between trust in government or government cooperation and efforts does not mean that a link does not exist. As Lucas et al. (2021: 288–289) argue, exploring such connections may require a mixed-methods approach that allows "local communities to tell their stories and views" that affords

policymakers an “understanding [of] exactly how local people will be socially impacted” by a project. This would require moving beyond a general population survey, requiring ethnographic studies, community engagement, and localized and small-scale data collection (Lucas et al., 2021: 289).

3.7 Lessons for the Public Sector

Our analysis of participant responses provides us with a number of lessons for policy makers, planners and engineers, and politicians across Central and Eastern Canada. These lessons are extrapolated from the findings of each cluster.

It is important to state that overall, our research finds that Canadians want A) greater action to mitigate the consequences of global warming, and B) greater cooperation and climate action from the different levels of government. This is consistent with the literature on perceptions of climate change which notes that Canadians want governments to do more to address a warming world (Hatch et al., 2024; Martel-Morin and Lachapelle, 2022; Andre et al., 2024). These findings bode well for the future of climate and transport governance in Central and Eastern Canada: greater action and policy interventions are possible. At the same time, Canadians currently have low trust in government performance on climate to date, and they do not believe that the public sector has done all that it can to address global warming.

Lesson 1 – Central and Eastern Canadians are worried about global warming. Across Ontario, Quebec, Nova Scotia, and New Brunswick, residents believe that global warming is happening, and they have either directly felt its negative effects, or know people in their families and communities who have. This is consistent with a number of public opinion surveys of Canadians and those in the Global North that demonstrate that people are worried about global warming (see Hatch et al., 2024, for a review of climate concern and attribution of blame for climate change across provinces; see also Andre et al., 2024, and Martel-Morin and Lachapelle, 2022).

Lesson 2 – There is a desire to see greater government cooperation. Respondents noted that there is a desire for all levels of government, from municipalities, to provinces, to the federal government to work together to address climate change, and to implement supportive laws and programs that consider the environment. In a moment where there is diminishing citizen trust in government institutions and actions (Joquin, 2014; Jesuit, 2014; Hatch et al., 2024),

this should be seen as an opportunity to act to combat climate change. While there is often a discrepancy between people broadly supporting climate action, and support for specific interventions (Hatch et al., 2024; Martel-Morin and Lachapelle, 2022), this is a prospective opening to frame government interventions and actions as having public support.

Lesson 3 – There is a general lack of information about government actions to combat global warming. Respondents were found to be neutral in their knowledge about what different levels of government in Canada are doing to combat global warming. As we noted above, we interpret this to mean that respondents neither felt they had a strong knowledge base of what governments are doing, nor that there was a lack of knowledge. Within this context, there is an opportunity to raise awareness amongst constituents of what actions are taken to combat global warming. Chapter 2 outlined that public sector staff felt as though both politicians and residents were poorly informed about how road freight works and what actions need to be taken to decarbonize the industry. This result indicates that greater information sharing and awareness campaigns may help residents understand what actions are currently being taken within their communities, their provinces, and Canada more broadly, and what actions *could* be happening in the future. Such campaigns could help to attempt to push back and mitigate disinformation campaigns around climate change (Dembicki, 2022; CCDH, 2023; Delay, 2024). Moreover, information sharing and greater public awareness of how and why governments are implementing climate-oriented policies and actions may also help to build a sense of transparency and openness that is felt to be lacking by residents in jurisdictions across Canada and the global north (Höppner and Whitmarsh, 2012; Hughes, 2021; Walker and Baxter, 2017).

Lesson 4 – Respondents do not trust that the different levels of Canadian government will follow through on their stated actions. Overall, respondents felt negatively about the ability of all levels of government to follow through on actions such as passing laws and investing in their communities. This is consistent with findings in the literature that there is low trust in government on climate action (Hughes, 2021; Höppner and Whitmarsh, 2012). It is valuable to consider how this perceived lack of trust in government may interact with respondent desires to see greater public sector cooperation, and with the sense that there could be better information shared about government actions. If respondents do not feel as though they have all the adequate knowledge and understanding necessary about what governments are doing, it may follow that they may also feel that they have an inability to trust that their governments

are following through on their stated actions.[12] Future cooperation between different levels of government should strive to be more transparent. Even if the outcomes of greater cooperation between jurisdictions does not result in a respondents' desired outcome, meaningful and procedurally fair community engagement may result in public support (see Jesuit, 2014, Walker and Baxter, 2017).

Lesson 5 – Different levels of government are not currently cooperating well. Respondents noted that currently, no levels of government are cooperating well to address global warming. This aligns with the findings discussed in Lesson 2, where respondents want to see greater cooperation between public sector actors on climate change. There are a range of reasons that may explain the perceived lack of effective cooperation. First, much policymaking and legislating happens "behind the scenes", where it may not be clear who is involved across jurisdictions and how decisions are being made. This may result in the sense that there is poor cooperation, or that there is inadequate transparency around why decisions are made (Jesuit, 2014). Second, government agencies are often siloed, requiring the buy-in and engagement of multiple internal actors to make a decision, or to assent to another government actor's decision (Mazzucato and Collington, 2023). These internal government engagements take time and may lengthen how long it takes to implement a project or act, especially in a multi-level stakeholder environment. As such, the public might perceive that the length of time to make decisions means that cooperation is not as smooth as it could be. Finally, it may be the case that the organizational structures of respective public agencies and their cultures of decision-making may need to be refined to tackle complex, multi-stakeholder issues such as climate change. While there is an explicit division of powers in Canada that delegates responsibilities to each level of government, the complex nature of both climate and transportation means that actors are often implicated in ways that require clearer accountabilities, modes of communication, and decision-making mechanisms. Most recently, this has been seen in how municipalities have been asked to handle issues such as climate

[12] This is to say nothing of the fact that governments often turn their backs on or fail to implement previously stated commitments. The decision to not go forward with a stated commitment may be the right decision. However, it is important for governments to communicate why they are changing course, and to be clear about how they have made such decisions. There is also the risk that residents perceive the changing of course to be done for cynical reasons, such as to "buy" votes, or to benefit private interests (Doern et al., 2021). For three prominent Canadian examples where governments have changed course with different degrees of fallout, see the changes to the application of the Federal carbon tax in Nova Scotia (Tutton, 2023; Tombe and Winter, 2023; Rabson, 2023), the Province of Quebec's decision to not support the REM de L'Est light rail expansion when the project was taken from CDPQ and given to the public sector (Ouellette-Vézina, 2023; CBC News, 2023), and the Province of Nova Scotia's decision to not pass bipartisan coastal protection legislation despite widespread public support (Gorman, 2024).

change mitigation, transportation, homelessness, and housing. For example, municipalities are being asked to step up and respond to an explicitly provincial responsibility in the case of housing (Hachard et al., 2022).

Lesson 6 – Canadians do not believe that their governments are doing everything they can for the climate. Respondents expressed concerns that no levels of government are doing everything within their power to address global warming. Moreover, respondents did not believe that there is adequate financial support for communities, nor access to the right tools to properly address global warming. As such, there is a perceived gap between the climate problems that Canadian communities face and the tools, funding, and actions needed to address them.

3.8 Findings: Analysis 2 - Infrastructure Interventions

The purpose of this analysis was to understand and assess who respondents felt should be responsible for a range of policy interventions and actions associated with road freight. All interventions but one (funding expansions of highways and roads) have been proposed in the literature as supporting the decarbonization of road freight. Funding the expansions of highways and roads represents a business-as-usual case within the context of decarbonization.

What follows is a breakdown of how respondents allocated responsibility for each of the policy interventions and actions. For a comparison of what levels of government are currently responsible for each intervention, and how respondents believed responsibilities should be allocated see Table 3.9 Current Governance Model for Road Freight Interventions.

Table 3.9 Current Governance Model for Road Freight Interventions

Policies and Interventions	Current Governance Model
Coordinating new logistics centres and industrial parks (INFRA_47)	Municipally or Regionally Led Occasional Federal involvement based on investment and presence of rail and marine connections
Organizing regional agencies to coordinate transboundary transportation projects (INFRA_48)	Provincially Led
Supporting regional and national building standards for commercial and industrial construction (INFRA_49)	Municipally or Provincially Led Federal involvement in development of codes (national)
Integrating environmental data with zoning data (INFRA_50)	Municipally or Provincially Led
Funding and support for private sector ownership of electric delivery vehicles (INFRA_51)	Federally or Provincially Led
Funding and support for electric vehicle charging infrastructure on highways (INFRA_52)	Municipal, Provincial, and Federal contributions
Funding and support for private sector R&D in green freight vehicle technology (INFRA_53)	Municipal, Provincial, and Federal partnerships
Funding and support for academic R&D in green freight vehicle technology (INFRA_54)	Municipal, Provincial, and Federal partnerships
Funding for rail freight corridor expansions (INFRA_55)	Federally led
Funding expansions of highways and roads (INFRA_56)	Municipal, Regional, and Provincially Led

We also note where there are significant or partially significant relationships between beliefs in different levels of government holding accountabilities for each intervention and socio-demographic characteristics. Policy interventions are broken down into federal, provincial, and municipal accountabilities.

3.8.1 Coordinating new logistics centres and industrial parks

Approximately 51% (50.8%) identified the provincial government as the appropriate level of government to be accountable for the coordination of new industrial zones and facilities. 41.05% and 37.62% noted that the federal and municipal governments, respectively, should

be involved in this intervention. See Table 3.10 Coordinating new logistics centres and industrial parks for a breakdown of significant and partially significant results.

Table 3.10 Coordinating new logistics centres and industrial parks[13]

Coordinating new logistics centres and industrial parks (INFRA_47)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA_47.1) & Education	14.402	7	0.044
Provincial Responsibility (INFRA_47.2) & Province	7.369	3	0.061
Provincial Responsibility (INFRA_47.2) & Education	13.647	7	0.058
Provincial Responsibility (INFRA_47.2) & Proximity Industry	8.402	2	0.015
Provincial Responsibility (INFRA_47.2) & Proximity Highway	8.979	2	0.011
Municipal Responsibility (INFRA_47.3) & Province	6.701	3	0.082
Municipal Responsibility (INFRA_47.3) & Education	22.325	7	0.002
Municipal Responsibility (INFRA_47.3) & Proximity Energy	5.207	2	0.074
Municipal Responsibility (INFRA_47.3) & Proximity Highway	10.133	2	0.006

Federal Responsibility. The only socio-demographic characteristic with a significant relationship to belief in federal responsibility is education (p = .044). Respondents with higher levels of education were more likely to express a desire to see the federal government take on responsibilities for the development of industrial parks. Approximately fifty-five percent (55.4%) of respondents with bachelor's degrees, 41.4% of those with master's degrees, and 60.0% of those with doctoral degrees wanted to see federal involvement. Conversely, respondents with a technical degree (32.1%), who completed some university programming (25%), or who completed secondary/high school (32.2%) were less likely to believe the federal government should be involved in the development of industrial parks.

Provincial Responsibility. Province of residence (p = .061) and educational level (p = .058) were found to be partially significant in explaining belief in provincial accountability for coordinating new logistics centres and industrial parks. Approximately fifty-nine percent (59.1%) of respondents from Nova Scotia and 58% of respondents from Quebec indicated that their provincial government should be involved in the siting of industrial parks and logistics facilities. Approximately forty-three percent (43.3%) of respondents from Ontario thought the

[13] Green represents significant results, and orange represents partially significant results

provincial government should make such decisions, while only 38.1% of New Brunswick respondents thought this should be a responsibility of the province. Respondents across the range of educational backgrounds thought the provincial government should have a role in coordinating the placement of logistics facilities and industrial parks. For instance, 58.6% of respondents with unfinished technical or community college experience, 51.8% of respondents who completed community or technical college, as well as those with unfinished post-secondary education (56.3%), a bachelor's degree (60.2%), or a doctoral degree (60.0%) thought this was a key policy for which the provincial government should be responsible. Respondents with some secondary education (37.5%) or who have completed secondary schooling (32.2%) were less likely to see this as a key area of accountability for provincial governments.

Proximity to industrial parks ($p = .015$) and proximity to highways were significant characteristics ($p = .011$). Approximately fifty-five percent (55.6%) of respondents who live within a 20-minute drive of an industrial park or logistics facility believed that the provincial government should have accountabilities for siting such land uses. Approximately sixty-two percent (62.3%) of respondents who do not live within a 20-minute drive of an industrial park thought that such an intervention should not be the responsibility of the provincial government. Approximately fifty-three percent (53.3%) of respondents who live within a 10-minute drive of a highway noted that the provincial government should have accountabilities for coordinating the placement of logistics centres and industrial parks. Approximately seventy-three (73.5%) of respondents who do not live near a highway thought that the provincial government should not be responsible for such an intervention.

Municipal Responsibility. Education ($p = .002$) and proximity to highways ($p = .006$) were found to be significant characteristics. Respondents with bachelor's degrees and doctoral degrees were most likely to believe this should be a key responsibility for municipal governments at 51.8% and 60% of respondents, respectively. Those with lower levels of education were less likely to see this as a municipal responsibility. Approximately eighty-five percent (85.3%) of respondents who did not live near highways thought that municipalities should not be responsible for the siting of industrial facilities. Approximately sixty percent (59.8%) of respondents who do live near highways think that municipalities should not be accountable for the siting of industrial facilities.

Province of residence (p = .082) and proximity to energy infrastructure (p = .074) were found to be partially significant characteristics. Most respondents did not feel strongly about the municipal role in coordinating the locations of logistics centres and industrial parks from province to province. For instance, Nova Scotians were most likely to believe that this should be a municipal accountability at 45.5% of respondents, followed by Ontario residents (43.3%), while only 33.3% of New Brunswick residents and 28.6% of Quebecers saw this as a key responsibility for municipal government. Sixty-nine percent of respondents who did not live within proximity to energy infrastructure indicated that they did not think municipalities should be responsible for the placement of industrial parks and logistics facilities, while 58.8% of respondents who did not live near energy infrastructure also think they should not be accountable for this intervention.

3.8.2 Organizing regional agencies to coordinate transboundary transportation projects

Respondents identified the provincial governments and federal governments as the primary levels of government to lead the development of regional agencies at 50.82% and 46.35%, respectively. Only 30.56% of respondents thought that municipalities should be involved in such an intervention. See Table 3.11 Organizing regional agencies to coordinate transboundary transportation projects for a breakdown of partially significant results.

Table 3.11 Organizing regional agencies to coordinate transboundary transportation projects[14]

Organizing regional agencies to coordinate transboundary transportation projects (INFRA_48)	Pearson Chi-Square	Degrees of Freedom	P-Value
Municipal Responsibility (INFRA_48.3) & Proximity Energy	7.789	4	0.1

No characteristics were found to have a significant or partially significant relationship to the belief that the federal or provincial government should be responsible for organizing regional agencies.

Municipal Responsibility. There is a partially significant relationship to proximity to energy infrastructure (p = .1). Approximately seventy-three percent (73.4%) of respondents who do not live near energy infrastructure indicated that they believe municipalities should not be responsible for organizing regional agencies. Approximately seventy one percent (70.6%) of

[14] Orange represents partially significant results.

respondents who did live near energy infrastructure indicated that they believe municipalities should not be responsible for organizing regional agencies.

3.8.3 Supporting regional and national building standards for commercial and industrial construction

Approximately fifty-five percent (55.11%) identified the province as the actor that should lead the development and adoption of building codes. Approximately forty-nine percent (49.50%) indicated that the federal government should also be involved. Only 34.43% noted that municipalities should play a role in supporting such standards. See Table 3.12 Supporting regional and national building standards for commercial and industrial construction for a breakdown of significant and partially significant results.

Table 3.12 Supporting regional and national building standards for commercial and industrial construction[15]

Coordinating new logistics centres and industrial parks (INFRA_47)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA_47.1) & Education	14.402	7	0.044
Provincial Responsibility (INFRA_47.2) & Province	7.369	3	0.061
Provincial Responsibility (INFRA_47.2) & Education	13.647	7	0.058
Provincial Responsibility (INFRA_47.2) & Proximity Industry	8.402	2	0.015
Provincial Responsibility (INFRA_47.2) & Proximity Highway	8.979	2	0.011
Municipal Responsibility (INFRA_47.3) & Province	6.701	3	0.082
Municipal Responsibility (INFRA_47.3) & Education	22.325	7	0.002
Municipal Responsibility (INFRA_47.3) & Proximity Energy	5.207	2	0.074
Municipal Responsibility (INFRA_47.3) & Proximity Highway	10.133	2	0.006

Federal Responsibility. Area of residence (p = .016), proximity to industrial parks (p = .025), energy infrastructure (p = .033), and highways (p = .001) were all found to be significant characteristics. Approximately sixty-nine percent (68.9%) of respondents who live in rural areas did not believe that supporting regional and national building standards should be a federal responsibility, while 51.7% of respondents who live in urban environments do not see it as a federal accountability. Approximately fifty-eight percent (58.1%) of suburban respondents felt it should be a federal responsibility. Approximately sixty-five percent (65.5%)

[15] Green represents significant results, and orange represents partially significant results.

of respondents who did not live near industrial parks believe that supporting regional and national building codes should not be a federal accountability. Approximately fifty-four percent (54.1%) of respondents who did live near industrial parks believe it should be a federal accountability.

Respondents who lived near energy infrastructure (p = .033) were evenly split on their perceptions that the federal government should be responsible for supporting regional and national building standards. 55.7% of respondents who did not live near energy infrastructure didn't think this should be a federal responsibility. Approximately seventy-nine percent (79.4%) of respondents who did not live near highways (p = .001) believed that supporting regional and national building codes should not be a federal responsibility. Approximately fifty-three percent (53.3%) of respondents who did live near a highway believed that it should be a federal responsibility.

Provincial Responsibility. Proximity to energy infrastructure (p = .015) and to highways (p = .03) were significant characteristics. Approximately sixty-four percent (63.7%) of respondents who lived near energy infrastructure perceived that supporting regional and national building standards should be a provincial responsibility, while 52.5% of respondents who did not live near energy infrastructure thought that the province should not be accountable for this. Approximately sixty-five percent (64.7%) of respondents who did not live near a highway believed that supporting regional and national building standards should not be a provincial responsibility, while 58.3% of respondents who did live near highways believed the province should be involved.

Education (p = .052) was a partially significant socio-demographic characteristic. Most respondents across educational groups perceived providing support for regional and national building standards to be the responsibility of the provincial government. For instance, respondents with some technical college completed (55.2%), some university completed (55.4%), a bachelor's degree (68.8%), a master's degree (67.5%), and a doctorate degree (60%) all perceive this to be a provincial responsibility. Respondents who did not complete high school (68.8%) and who completed high school (57.6%) were more likely to believe that this should not be a provincial responsibility.

Municipal Responsibility. Education was found to be a significant characteristic (p = .038) while gender (p = .092) was partially significant. Across all educational levels, respondents

were more likely to believe that providing support for regional and national building standards should not be a municipal responsibility: 62.5% of those who have some secondary education, 72.9% of those who completed high school, 78.6% who completed technical college, 81.1% of those who have some university education, 56.6% of those with a bachelor's degree, 62.1% of those with a master's degree, and 80% of those with a doctoral degree all perceive this to not be a key accountability of municipal government. Only those with some technical college education (51.7%) perceived this to be a municipal responsibility.

70.4% of men and 61.1% of women believe that support for regional and national building standards should not be a municipal responsibility.

3.8.4 Integrating environmental data with zoning data

Respondents identified provincial governments as the leading actor for integrating environmental and zoning data (50.29%). Respondents noted that the federal government (45.69%) and municipalities (44.7%) should also have some involvement. See Table 3.13 Integrating environmental data with zoning data for a breakdown of significant and partially significant results.

Table 3.13 Integrating environmental data with zoning data[16]

Integrating environmental data with zoning data (INFRA 50)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA 50.1) & Area Lived	9.722	3	0.021
Federal Responsibility (INFRA 50.1) & Proximity Energy	7.354	2	0.025
Federal Responsibility (INFRA 50.1) & Proximity Highway	5.733	2	0.057
Provincial Responsibility (INFRA 50.2) & Proximity Highway	8.059	2	0.018
Municipal Responsibility (INFRA 50.3) & Province	6.361	3	0.095

Federal Responsibility. Area of residence (p = .021) and proximity to energy infrastructure (p = .025) were both significant characteristics, while proximity to highways was a partially significant characteristic (p = .057). Approximately fifty-seven percent (56.6%) and 71.1% of respondents who lived in urban and rural areas believe that integrating environmental data with zoning data was not a key responsibility of the federal government, respectively. Approximately fifty-four percent (54.3%) of respondents who lived in suburban areas believed

[16] Green represents significant results, and orange represents partially significant results.

this should be a key responsibility of the federal government. Approximately sixty percent (59.5%) of respondents who did not live near energy infrastructure believe the federal government should not be involved in integrating environmental and zoning data. Approximately fifty-five percent (54.9%) of respondents who lived near energy infrastructure also believe this should not be a federal responsibility. Respondents who lived near (73.5%) highways and who did not live near highways (52.1%) were more likely to believe that integrating zoning and environmental data should not be the responsibility of the federal government.

Provincial Responsibility. Proximity to highways was found to be a significant characteristic ($p = .018$). 64.7% of respondents who did not live near a highway were more likely to believe the provincial government should not be responsible for integrated zoning and environmental data. Approximately sixty percent (59.8%) of respondents who did live near highways believed this should be a provincial responsibility.

Municipal Responsibility. Province of residence was found to be a partially significant characteristic ($p = .095$). Respondents in Ontario (53.7%), Quebec (60.5%), and New Brunswick (57.1%) were more likely to believe that integrating environmental and zoning data was not a key municipal responsibility. Nova Scotian respondents were more likely to believe that this should be a municipal responsibility (68.2%).

3.8.5 Funding and support for private sector ownership of electric delivery vehicles

Respondents noted that the federal government should lead funding and support for private sector uptake of electric vehicles (51.49%). Fewer respondents noted that provincial governments should also provide funding and support (43.04%), while only 19.53% thought municipalities should provide support. See Table 3.14 Funding and support for private sector ownership of electric delivery vehicles for a breakdown of significant and partially significant results.

Table 3.14 Funding and support for private sector ownership of electric delivery vehicles[17]

Funding and support for private sector ownership of electric delivery vehicles (INFRA 51)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA 51.1) & Education	13.681	7	0.057
Federal Responsibility (INFRA 51.1) & Proximity Industrial	5.305	2	0.07
Federal Responsibility (INFRA 51.1) & Proximity Highway	7.59	2	0.022
Provincial Responsibility (INFRA 51.2) & Province	7.226	3	0.065
Provincial Responsibility (INFRA 51.2) & Area Lived	12.975	3	0.005
Provincial Responsibility (INFRA 51.2) & Proximity Industrial	7.404	2	0.025
Provincial Responsibility (INFRA 51.2) & Proximity Energy	5.882	2	0.053
Provincial Responsibility (INFRA 51.2) & Proximity Highway	6.275	2	0.043
Municipal Responsibility (INFRA 51.3) & Province	6.919	3	0.075
Municipal Responsibility (INFRA 51.3) & Age	5.61	2	0.06

Federal Responsibility. Proximity to industrial parks (p = .07) and highways (p = .022) were found to be significant characteristics, while education was found to be partially significant (p = .057). Approximately fifty-six percent (55.7%) of respondents who did not live near industrial parks perceived the funding and support for private sector ownership of electric delivery vehicles not to be a federal responsibility, while 55.6% of respondents living near industrial parks did. Approximately seventy-one percent (70.6%) of respondents who did not live near a highway were more likely to believe the federal government should not support private ownership of electric delivery vehicles. Approximately fifty-four percent (54.1%) of respondents who did live near highways believed this should be a federal responsibility. Respondents with unfinished secondary education (68.8%), completed secondary education (64.4%), some university education (56.3%), a master's degree (51.7%), and a doctoral degree (60.0%) were more likely to believe that it should not be the responsibility of the federal government to fund and support private sector ownership of electric delivery vehicles. Respondents with some technical college education (58.6%), who completed technical college (58.9%), and who had a bachelor's degree (60.2%) were more likely to believe that this should be a federal responsibility.

Provincial Responsibility. Area of residence (p = .005), proximity to industrial parks (p = .025), and proximity to highways (p = .043) were found to be significant characteristics. 51.7% of

[17] Green represents significant results, and orange represents partially significant results.

urban respondents, 80% of rural respondents, and 54.3% of suburban respondents all perceived the funding and support for private sector ownership of delivery vehicles to not be a provincial responsibility. Approximately seventy-two percent (72.1%) of respondents who did not live near industrial parks, and 52.7% of respondents who did live near industrial parks believe that funding and support for private ownership of electric delivery vehicles should not be a provincial responsibility. Both respondents who did not live near highways (76.5%) and those who did (54.1%) believed that funding and support for private ownership of electric vehicles should not be a provincial responsibility.

Province of residence ($p = .065$) and proximity to energy infrastructure ($p = .053$) were found to be partially significant characteristics. Approximately fifty-eight percent (58.2%) of Ontario respondents, 66.7% of New Brunswick respondents, and 77.3% of Nova Scotian respondents all believed that funding and support for private sector ownership should not be a provincial responsibility. Approximately fifty percent (50.4%) of respondents from Quebec believed that there should be some provincial funding and support for private sector ownership of electric delivery vehicles. Approximately sixty percent (60.1%) of respondents who did not live near energy infrastructure believe that funding and support for private ownership is not a provincial responsibility, while 52.0% of respondents who did live near such infrastructure believe there should be some provincial responsibility.

Municipal Responsibility. Province of residence ($p = .075$) and age ($p = .06$) were found to be partially significant characteristics. Across all provinces, respondents were more likely to believe that municipal governments should not have responsibilities for funding and support of private sector EV ownership. Approximately seventy-six percent (76.1%) of respondents from Ontario, 87.4% of respondents from Quebec, 71.4% of respondents from New Brunswick, and 86.4% of respondents from Nova Scotia all perceived this to not be a municipal responsibility. Across all age groups, respondents perceived funding and support for private ownership of electric delivery vehicles to not be a municipal responsibility: 79% of respondents between 18 and 35, 77.2% of respondents between 36 and 55, and 90.4% of respondents over 60.

3.8.6 Funding and support for electric vehicle charging infrastructure on highways

Support for charging infrastructure on highways was seen as primarily the responsibility of the federal government (63.45%), with 47.52% seeing a role for the provinces. Only 19.86% saw

the municipalities as having a role to play in supporting and funding EV charging infrastructure. See Table 3.15 Funding and support for electric vehicle charging infrastructure on highways for a breakdown of partially significant results.

Table 3.15 Funding and support for electric vehicle charging infrastructure on highways[18]

Funding and support for electric vehicle charging infrastructure on highways (INFRA_52)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA 52.1) & Education	21.817	14	0.082
Federal Responsibility (INFRA 52.1) & Proximity Highway	7.986	4	0.092

No characteristics were found to have a significant or partially significant relationship to the belief that provincial or municipal governments should provide funding and support for EV charging infrastructure on highways.

Federal Responsibility. Education (p = .082) and proximity to highways (p = .092) were found to be partially significant characteristics. Respondents with some secondary education (56.3%) and respondents who completed secondary school (55.9%) were more likely to believe that it is not the responsibility of the federal government to provide funding and support for the provision of EV charging infrastructure on highways. Conversely, respondents who completed some technical college (79.3%), completed technical college (69.6%), completed some university (68.8%), have a bachelor's degree (69.9%), have a master's degree (68.6%), and have a doctoral degree (80%) all perceived this to be a federal responsibility. Respondents who did not live near a highway (55.9%) were more likely to believe that it is not the responsibility of the federal government to provide funding and support for the provision of EV charging infrastructure on highways. Respondents who did live near a highway (66.4%) were more likely to believe that it is the responsibility of the federal government to provide funding and support for the provision of EV charging infrastructure on highways.

3.8.7 Funding and support for private sector R&D in green freight vehicle technology

Respondents identified the Federal government as the primary actor to provide private sector R&D support (60.72%). Approximately forty-four percent (44.37%) believed the provincial government should be involved, while only 18.87% saw a role for municipalities.

[18] Orange represents partially significant results.

See Table 3.16 Funding and support for private sector R&D in green freight vehicle technology for a breakdown of significant results.

Table 3.16 Funding and support for private sector R&D in green freight vehicle technology[19]

Funding and support for private sector R&D in green freight vehicle technology (INFRA_53)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA_53.1) & Education	24.981	14	0.035

No characteristics were found to have a significant or partially significant relationship to the belief that provincial or municipal governments should provide funding and support for private sector R&D in green freight vehicle technology.

Federal Responsibility. Education (p = .035) was found to be a significant characteristic. Respondents who have a secondary school diploma (59.3%) were more likely to believe that it should not be the responsibility of the federal government to provide funding and support for private sector R&D for green freight vehicle technology. Respondents who did not complete secondary school were evenly split on whether this should be a federal responsibility. Respondents who completed some technical college (58.6%), who completed technical college (71.4%), who completed some university (62.5%), or who have a bachelor's degree (67.5%), a master's degree (62.1%), or a doctoral degree (80%) were more likely to believe that this should be a federal responsibility.

3.8.8 Funding and support for academic R&D in green freight vehicle technology

Respondents saw a role for both the federal and provincial governments in supporting academic R&D (57.61% and 51.48%, respectively). Only 19.47% of respondents thought municipalities should provide funding and support to academic R&D for green freight technology. See Table 3.17 Funding and support for academic R&D in green freight vehicle technology for a breakdown of significant and partially significant results.

[19] Green represents statistically significant results.

Table 3.17 Funding and support for academic R&D in green freight vehicle technology[20]

Funding and support for academic R&D in green freight vehicle technology (INFRA_54)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA_54.1) & Proximity Industrial	15.393	4	0.004
Federal Responsibility (INFRA_54.1) & Proximity Highway	10.923	4	0.027
Provincial Responsibility (INFRA_54.2) & Proximity Industrial	17.794	4	0.001
Provincial Responsibility (INFRA_54.2) & Proximity Highway	11.566	4	0.021
Municipal Responsibility (INFRA_54.3) & Age	8.323	4	0.08
Municipal Responsibility (INFRA_54.3) & Proximity Industrial	9.685	4	0.046
Municipal Responsibility (INFRA_54.3) & Proximity Highway	8.502	4	0.075

Federal Responsibility. Proximity to industrial parks (p = .004) and to highways (p = .027) were found to be significant characteristics. Respondents who did not live near industrial parks were more likely to believe that it is not the responsibility of the federal government to support academic R&D (55.7%). Respondents who lived near industrial parks (62.4%) were more likely to believe that support for academic R&D is a federal responsibility. Approximately fifty-three percent (52.9%) of respondents who did not live near highways perceived support for academic R&D to not be a federal responsibility, while 59.8% of respondents who lived near highways did.

Provincial Responsibility. Proximity to industrial parks (p = .001) and to highways (p = .021) were found to be significant characteristics. Approximately sixty-four percent (63.9%) of respondents who did not live near highways perceived support for academic R&D to not be the responsibility of the provincial government, while 57.1% of respondents who lived near industrial parks did. Approximately sixty-two percent (61.8%) of respondents who do not live near highways perceived support for academic R&D to not be a provincial responsibility, while 53.7% of respondents who live near highways did.

Municipal Responsibility. Proximity to industrial parks (p = .046) was found to be a significant characteristic, while age (p = .08) and proximity to highways (p = .075) were partially significant. Approximately seventy-nine percent (78.7%) of respondents who did not live near industrial parks, and 82% of respondents who did live near industrial parks believed that funding and support for academic R&D should not be the responsibility of municipal governments. Respondents across all age groups were more likely to believe that

[20] Green represents significant results, and orange represents partially significant results.

municipalities should not have responsibilities to provide funding and support for academic R&D in green freight vehicle technology: 73% of respondents 18 to 35, 81.3% of respondents between 36 and 55, and 89% of respondents over 60. Approximately seventy-nine percent (79.4%) of respondents who do not live near highways, and 80.3% of respondents who did live near highways believed that funding and support for academic R&D should not be the responsibility of municipal governments.

3.8.9 Funding for rail freight corridor expansions

Respondents saw the funding of rail freight expansions as primarily being the responsibility of the federal government (72.27%). Only 34.65% of respondents saw a role for the provinces, and even fewer (14.90%) saw a role for municipal governments. See Table 3.18 Funding for rail freight corridor expansions for a breakdown of significant and partially significant results.

Table 3.18 Funding for rail freight corridor expansions[21]

Funding for rail freight corridor expansions (INFRA_55)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA_55.1) & Age	10.742	4	0.03
Federal Responsibility (INFRA_55.1) & Education	32.688	14	0.003
Provincial Responsibility (INFRA_55.2) & Province	11.973	6	0.063
Provincial Responsibility (INFRA_55.2) & Age	12.937	4	0.012
Provincial Responsibility (INFRA_55.2) & Education	26.621	14	0.022
Municipal Responsibility (INFRA_55.3) & Province	12.617	6	0.05
Municipal Responsibility (INFRA_55.3) & Education	28.672	14	0.012

Federal Responsibility. Age (p = .03) and education (p = .003) were significant characteristics. Respondents across all age groups were more likely to believe that the federal government should provide funding for rail freight corridor expansions: 64% of respondents between 18 and 35, 71.5% of respondents between 36 and 55, and 84.9% of respondents over 60. Respondents across all education levels were more likely to believe that the federal government should provide funding for rail freight corridor expansions: 62.5% of respondents who did not finish high school, 75% of respondents who completed high school, 79.3% of respondents who have some technical college education, 76.8% of respondents who completed technical college, 75% of respondents with some university education, 80.7% of

[21] Green represents significant results, and orange represents partially significant results.

respondents with a bachelor's degree, 62.1% of respondents with a master's degree, and 100% of respondents with a doctoral degree.

Provincial Responsibility. Age (p = .012) and education (p = .022) were significant characteristics. Respondents across all age groups were more likely to believe that the provincial government should not provide funding for rail freight corridor expansions: 75% of respondents between 18 and 35, 53.7% of respondents between 36 and 55, and 69.9% of respondents over 60. Respondents across all education levels were more likely to believe that the provincial government should not provide funding for rail freight corridor expansions: 56.3% of respondents who did not finish high school, 72.9% of respondents who completed high school, 65.5% of respondents who have some technical college education, 76.8% of respondents who completed technical college, 62.5% of respondents with some university education, 59% of respondents with a bachelor's degree, 51.7% of respondents with a master's degree, and 60% of respondents with a doctoral degree.

Province of residence (p = .063) was found to be a partially significant characteristic. Approximately sixty-one percent (61.2%) of respondents from Ontario, 73.9% of respondents from Quebec, and 59.1% of respondents from Nova Scotia believe that the provincial government should not be responsible for funding the expansion of rail freight corridors. Approximately fifty-seven percent (57.1%) of respondents from New Brunswick believed that their provincial government should have some responsibility to provide funding for such expansions.

Municipal Responsibility. Province of residence (p = .05) and education (p = .012) were found to be significant characteristics. Respondents residing in all provinces were more likely to believe that municipal governments should not be involved in the funding of rail freight corridor expansions: 80.6% from Ontario, 90.8% from Quebec, 71.4% from New Brunswick, and 95.5% of respondents from Nova Scotia. Respondents across all education levels were more likely to believe that the municipal government should not provide funding for rail freight corridor expansions: 68.8% of respondents who did not finish high school, 88.1% who completed high school, 86.2% who have some technical college education, 92.9% who completed technical college, 87.5% with some university education, 78.3% with a bachelor's degree, 86.2% with a master's degree, and 100% with a doctoral degree.

3.8.10 Funding expansions of highways and roads

Respondents perceived the federal and provincial government to be the actors with key accountabilities for funding roadway expansions (71.42% and 53.97%, respectively). Only 26.82% saw a role for municipalities in funding highway and roadway expansions. See Table 3.19 Funding expansions of highways and roads for a breakdown of significant and partially significant results.

Table 3.19 Funding expansions of highways and roads[22]

Funding expansions of highways and roads (INFRA_56)	Pearson Chi-Square	Degrees of Freedom	P-Value
Federal Responsibility (INFRA_56.1) & Education	26.001	14	0.026
Federal Responsibility (INFRA_56.1) & Proximity Highway	8.999	4	0.061
Provincial Responsibility (INFRA_56.2) & Age	11.132	4	0.025
Provincial Responsibility (INFRA_56.2) & Education	27.872	14	0.015
Municipal Responsibility (INFRA_56.3) & Province	14.514	6	0.024
Municipal Responsibility (INFRA_56.3) & Education	34.101	14	0.002

Federal Responsibility. Education (p = .026) was found to be a significant characteristic, and proximity to highways (p = .061) is a partially significant one. Respondents across all education levels were more likely to believe that the federal government should provide funding for highway and road expansions: 62.5% of respondents who did not finish high school, 61% of respondents who completed high school, 72.4% of respondents who have some technical college education, 78.6% who completed technical college, 62.5% with some university education, 75.9% with a bachelor's degree, 65.5% with a master's degree, and 100% with a doctoral degree. Respondents who did not live near highways were evenly split on whether the federal government should be responsible for funding the expansion of highways and roads, while 74.1% who did live near highways believed that such funding should come from the federal government.

Provincial Responsibility. Age (p = .025) and education (p = .015) were both found to be significant socio-demographic characteristics. 65% of respondents between 36 and 55 believe

[22] Green represents significant results, and orange represents partially significant results.

that the provincial government should fund road and highway expansions, while 54% of those between 18 and 35, and 50.7% of those over 60 do not believe this should be a responsibility of their provincial governments. Respondents who have some high school education (56.3%), some technical college education (65.5%), have completed technical college (53.6%), have a bachelor's degree (59%), or a master's degree (69%) are more likely to believe that the provincial government should have some responsibility in funding the expansion of highways and roads. Those who have completed high school (59.3%), have completed some university (56.3%), and have a doctoral degree (60%) are more likely to believe that the provincial government should not be responsible for highway and road expansion funding.

Municipal Responsibility. Province of residence ($p = .024$) and education ($p = .002$) were found to be significant socio-demographic characteristics. Respondents across all provinces are more likely to believe that funding expansions of highways and roads should not be the responsibility of municipalities: 65.7% of respondents from Ontario, 84% of respondents from Quebec, 71.4% of respondents from New Brunswick, and 63.6% of respondents from Nova Scotia. Respondents who have some high school education (56.3%) are more likely to believe that the municipal government should have some responsibility for funding the expansion of highways and roads. Respondents who have finished high school (83.1%), who have completed some technical college (58.6%), who have completed technical college (80.4%), who have completed some university (81.3%), who have completed a bachelor's degree (69.9%), have a master's degree (75.9%), or have a doctoral degree (80%) were more likely to believe that such funding should not be a municipal responsibility.

Considering participant perceptions of which levels of government should be responsible for the above policy interventions and actions, we negatively answer *RQ6*. We note that for some interventions, respondents believe that the right level of government is currently responsible for interventions such as funding rail freight corridor expansions, and the organization of regional agencies to coordinate transportation projects. However, respondents tended to propose that the provincial and federal governments should be more involved and responsible in the proposed policy interventions and actions than they are under the current road freight governance model.

In light of participant responses, we positively answer *RQ7.* We note that education, age, and province of residence were sociodemographic characteristics that had a significant or partially

significant relationship to respondent perceptions of what levels of government should be accountable for road freight interventions. Gender was found to be partially significant for one intervention (building standards). Other characteristics that had significant or partially significant relationships included area of residence, proximity to industrial parks, proximity to highways, and proximity to energy infrastructure. Employment status, income, and ethnicity were not found to have a significant or partially significant relationship amongst respondents to their beliefs in what levels of government should be involved in the provided policy interventions and actions.

3.9 Discussion 2: Perceptions of the Governance of Infrastructure Interventions

This section outlines respondent perceptions about what levels of government should be responsible for road freight actions and policy interventions. For a breakdown of how survey respondents compare to the current allocation of accountabilities for each policy and action, see Table 3.20 Road Freight Policies and Interventions – Existing and Proposed Responsibilities.

Table 3.20 Road Freight Policies and Interventions – Existing and Proposed Responsibilities

Policies and Interventions	Current Governance Model	Respondent Proposed Governance Model
Coordinating new logistics centres and industrial parks (INFRA_47)	Municipally or Regionally Led Occasional Federal involvement based on investment and presence of rail and marine connections	Provincially Led, Federal Involvement
Organizing regional agencies to coordinate transboundary transportation projects (INFRA_48)	Provincially Led	Provincially Led, Federal Involvement
Supporting regional and national building standards for commercial and industrial construction (INFRA_49)	Municipally or Provincially Led Federal involvement in development of codes (national)	Provincially Led, Federal Involvement
Integrating environmental data with zoning data (INFRA_50)	Municipally or Provincially Led	Provincially Led, Federal and Municipal Involvement
Funding and support for private sector ownership of electric delivery vehicles (INFRA_51)	Federally or Provincially Led	Federally Led, Provincial Involvement
Funding and support for electric vehicle charging infrastructure on highways (INFRA_52)	Municipal, Provincial, and Federal contributions	Federally Led, Provincial Involvement
Funding and support for private sector R&D in green freight vehicle technology (INFRA_53)	Municipal, Provincial, and Federal partnerships	Federally Led, Provincial Involvement
Funding and support for academic R&D in green freight vehicle technology (INFRA_54)	Municipal, Provincial, and Federal partnerships	Federally and Provincially Led
Funding for rail freight corridor expansions (INFRA_55)	Federally led	Federally Led
Funding expansions of highways and roads (INFRA_56)	Municipal, Regional, and Provincially Led	Federally and Provincially Led

The focus of this section will be on the governance of the interventions, rather than how the sociodemographic characteristics of respondents shapes their perceptions of who should be accountable. There are two reasons for this. First, without doing further research and engagement with residents in each province, it is challenging to have a sense of the psychological motivations of why respondents believe different levels of government should be accountable for what actions. For example, does someone who is 55 or older think that their municipal government shouldn't have more responsibility because of a lack of faith in their competence? Does their provincial government perform well in their eyes based on local projects that are successful? Second, the focus of the following discussion is on A) how people believe each intervention should be distributed between government agencies, and B) how that compares to how they are currently allocated. This serves as a proxy for public knowledge of the road freight system and its composite parts, as well as a first glance at how respondents may prefer the system to be run. Further research should be undertaken to understand how and why people want different levels of government involved in different road freight interventions.

Table 3.21 Respondent Proposed Distribution of Responsibilities outlines how respondents believe each policy and intervention should be governed. A level of government was proposed to "lead" the intervention when over 50% of respondents indicated that they should have responsibility or jurisdiction over it. Where 40% to 50% of respondents identified an actor as relevant, they were deemed to be involved. 40% and under was interpreted as not being considered a significant actor for that intervention.

Table 3.21 Respondent Proposed Distribution of Responsibilities[23]

Policies and Interventions	Proposed Responsibility		
	Municipal	Provincial	Federal
Coordinating new logistics centres and industrial parks (INFRA_47)	37.62%	50.80%	41.05%
Organizing regional agencies to coordinate transboundary transportation projects (INFRA_48)	30.56%	50.82%	46.35%
Supporting regional and national building standards for commercial and industrial construction (INFRA_49)	34.43%	55.11%	49.50%
Integrating environmental data with zoning data (INFRA_50)	44.70%	50.29%	45.69%
Funding and support for private sector ownership of electric delivery vehicles (INFRA_51)	19.53%	43.04%	51.49%
Funding and support for electric vehicle charging infrastructure on highways (INFRA_52)	19.86%	47.52%	63.45%
Funding and support for private sector R&D in green freight vehicle technology (INFRA_53)	18.87%	44.37%	60.72%
Funding and support for academic R&D in green freight vehicle technology (INFRA_54)	19.47%	51.48%	57.61%
Funding for rail freight corridor expansions (INFRA_55)	14.90%	34.65%	72.27%
Funding expansions of highways and roads (INFRA_56)	26.82%	53.97%	71.42%

Overall, respondents expressed an interest in seeing greater provincial and federal involvement in the interventions proposed. Provincial governments and the federal government were identified as being suitable to lead or co-lead six of the ten interventions.

Respondent's beliefs on governance are at odds with how road freight is currently governed, where municipal or regional governments are implicated in many of the proposed interventions. For some interventions, such as support for funding and support for EV delivery vehicles, or private and academic R&D support, contributions and partnerships with other actors occur in parallel with each other (e.g., all levels of government may enter partnerships, or provide R&D support through materials or funding).

One explanation for a desire for greater provincial and federal involvement may be that respondents do not realize how much of their infrastructure is managed by municipal governments, nor how involved they are in different critical city-building functions, regardless of the formal division of powers (Gore, 2010). With such a line of thinking, respondents are signaling that they expect higher levels of government to have greater involvement in the transportation system and road freight system. Further research should explore what shapes one's opinions on what level of government should enact which policies, and for what reasons.

[23] Blue indicates that respondents believe that the jurisdiction in question should lead in implementing the intervention or policy. Green indicates that respondents believe the jurisdictions should be involved.

Only one intervention was perceived to be suitable for the involvement of municipal governments: integrating environmental data with zoning data. As Table 3.20 Road Freight Policies and Interventions – Existing and Proposed Responsibilities shows, under the current governance model of road freight, municipalities or upper-tier regional governments are responsible for a range of interventions, including the coordination of industrial parks and logistics centres, supporting building codes, integration of environmental and zoning data, and funding and support for private and academic R&D and EV infrastructure expansions. As all municipal powers are delegated to such actors from their provincial governments, it may be the case that respondents do not believe that municipalities have the expertise, resources, or funding to take on such interventions. Some of these interventions, such as the coordination of logistics centres and industrial parks or supporting building code standards are critical municipal functions through planning and engineering departments. As such, it is notable that respondents wish to see such interventions being led by provincial governments, with some federal involvement in building codes.

As transportation is regional in nature, it may follow that respondents wish to see industrial land use decisions being made at a larger scale than what is possible for a given municipality. In municipalities such as Halifax—which encompasses formerly distinct cities that house 13 industrial nodes—regional coordination of industrial land uses is possible, as one level of government has the power to make land use decisions across a wide area (see Watson and Associates Economists Ltd, 2020). Conversely, a region such as the Greater Montreal Area has 82 municipalities within proximity to each other, with each city making their own land use decisions while following a regional vision of development (PMAD, 2012). While the CMM—as a regional body—has jurisdiction over land use patterns and designations, decisions about industrial uses and zoning are still the responsibility of each municipality. As such, two municipalities may abut each other and have distinct rules about logistics uses and industrial development. This is an instance where the involvement of higher levels of government and greater cooperation between actors may benefit and strengthen land use decisions.

As the survey results indicate, there is a desire for greater cooperation between government actors. It follows that there would be multiple interventions that are perceived to benefit from co-direction or co-leading amongst actors. Nine out of ten interventions were identified as having a suitable place for two or more actors involved. Only the funding of rail freight corridor expansions was considered by respondents to sit within the federal government’s jurisdiction,

which is consistent with how rail is currently governed. Additionally, as some respondents believe that their local communities are ill-equipped to deal with the risks posed by climate change, it follows that they would want to see higher levels of government step in to provide support or to take responsibility for key transportation interventions.

3.10 Limitations

While adequate for this study, a key limitation to this research is the small sample size. A secondary limitation is that the Comité d'éthique de la recherche required that all questions include the option for respondents to abstain from answering, excepting those that would disqualify ineligible respondents (e.g., questions concerning province of residence and whether one worked for a public sector agency). This resulted in some prompts having missing responses. Other limitations include an ordering effect on questions resulting from the questions in different Phases not being randomized. The decision was made not to randomize questions and prompts, to allow respondents to thematically consider their responses. Finally, this survey was one snapshot of public perceptions, and happened before the federal Liberals announced that they would reconsider the broad application of the Carbon Tax for certain households in Atlantic Canada (Rabson, 2023). As this resulted in more prominent discourse on climate policy, it would be worthwhile to consider what the effects of such public discussions of policy would have on people's perceptions of road freight interventions and belief in climate change.

3.11 Conclusion

This chapter has provided a preliminary discussion of the public opinions on government trust, climate action, and level of effort of Canadian governments in Ontario, Quebec, New Brunswick, and Nova Scotia. It has also outlined what Canadians believe are the right levels of government to implement key policies and actions to decarbonize road freight. In the course of our analysis, we heard:

- Canadians are worried about the effects of global warming on their communities, and want to see stronger actions to mitigate these effects.
- Canadians have low trust that their governments follow through on their stated commitments, have the right tools to tackle climate change, and support other levels of government in achieving their goals.

- Canadians want higher levels of government (their provinces and the federal government) to provide better support for their municipalities.
- Canadians want to see greater cooperation between different levels of government on key interventions to decarbonize road freight. This includes having different jurisdictions potentially “co-leading” decarbonization efforts.

While trust in government may be improved, there are fertile grounds to build a social license to decarbonize road freight. Canadians want to trust their government and see greater climate action. This is a prime opportunity to take bold steps to decarbonize and to work with other levels of government in the process.

What this cooperation looks like, and the specifics of how different actors will interface on these interventions, is outside the scope of this research. When working on policies, efforts should be undertaken to consider how Canada’s governance of road freight and the transportation system more broadly may be reconstituted to most effectively decarbonize the industry. These findings indicate that regardless of how these actions are undertaken, the implementation will benefit greatly from multi-stakeholder, multi-jurisdictional efforts that meaningfully engage (where relevant) local communities. Canadians are primed to provide the social license needed to decarbonize road freight. As noted above, the interventions discussed are part of a toolkit that can facilitate a more sustainable road freight system—the question is not should we implement them, but which levels of governments will be responsible, and what part do residents play in the climate transition.

CHAPTER 4

THE SOCIAL DYNAMICS OF ROAD FREIGHT GOVERNANCE: PATHWAYS TOWARD DECARBONIZATION

4.1 Introduction

The purpose of this chapter is to provide an overview of the existing conditions of Central and Eastern Canada's road freight sub-system and present a proposal to reorient government action on road freight to be focused on decarbonization as a mission. We begin by summarizing the findings of Chapter 2 and 3 in order to provide a sketch of road freight's baseline conditions. We then explore how the roles of municipal, provincial, and federal actors may be reformed and enhanced to better govern road freight. These strategies are presented as tools and include citizens' assemblies, freight forums, and new national or regional government agencies. We conclude by proposing a new taxonomy of powers, responsibilities, and capacities for all actors in the road freight sub-system, with a focus on the elements of the system that make it hard to decarbonize.

This chapter addresses Sub-Objective 2.1 (Identifying international examples of transportation governance models and tools that may be viable in Canada's political, economic, and social context), Sub-Objective 2.2 (Developing an alternative governance structure for Canada's road freight subsystem), and Sub-Objective 2.3 (Identifying a taxonomy of actors, roles, powers, and capacities for an alternative road freight governance subsystem).

4.2 Public Sector Capacities, Public Sector Futures

Road freight governance, and by extension decarbonization, is a wicked problem that "cross[es] institutional and ecological boundaries" and requires government actors that operate at emergent "temporal and spatial scales" that go beyond how responsibilities are formally allocated (McAllister, 2024: 26). As we saw in Chapter 2, public sector staff are operating in political contexts defined by resource and capacity constraints. A range of issues divert their attention, making it a challenge to focus on road freight decarbonization. Within this context, Canada's transportation system, and road freight subsystem are hard to decarbonize: there are social, economic, political, and technical barriers to decarbonization.

The road freight sub-system is characterized by a many-to-many relationship between municipal, regional, provincial, and federal actors and by relationships between government, civil society, and the private sector. Moreover, the “physical” infrastructure of road freight (e.g., roads, logistics centres, and vehicles), institutional frameworks, and other transportation subsystems, such as marine and rail freight are entangled with each other. The result is that any effect on one component impacts the remaining road freight functions. An additional difficulty is that decarbonization pathways are non-linear: projects that are seemingly unrelated to sustainability and decarbonization may still impact efforts to meet climate targets.

It is within this context that public sector respondents recognize the need for context-specific solutions to the challenges of road freight decarbonization. Public staff noted that they are one set of actors within the tapestry of goods movement, and self-reported a limited degree of power: there was general consensus that the public sector is not “doing” road freight activities. Instead, the public sector serves an advisory, advocacy, or supporting role for an industry with responsibilities distributed across the public and private sector. The role of the public sector was thus perceived to be a minor role of creating conditions for the private sector to decarbonize road freight by establishing rules, programs, and policies that balance business interests with the public benefit. The public sector’s role was to advocate for better road freight planning. Road freight planning is currently hampered by inadequate information amongst politicians about the value of good movement to cities and regions, and a NIMBY attitude amongst residents when it comes to living near associated facilities, roads, and industrial parks.

From this position, the existing suite of tools for road freight decarbonization are limited for two reasons. First, public sector influence under current conditions is limited to setting the parameters for private sector activity as the public sector is not responsible for the road freight fleets and facilities. Second, road freight and decarbonization were not perceived by respondents to be joined-up in their respective government agencies. This limits the ability of government actors to meaningfully decarbonize road freight. Respondents noted that as the composite elements of road freight, such as roadway design, land use planning, and economic development, are distributed across and within government agencies, there is no “cross-cutting” or holistic view of decarbonization. As such, there is a perceived lack of overall accountability for decarbonizing road freight, and perceived influence from the public sector over goods movement.

Municipal actors were more likely to recognize that decarbonizing road freight requires acting beyond their boundaries and working with actors on matters that exceed their formal influence. As such, municipal actors implicitly recognized that regional collaboration was essential to govern road freight decarbonization. Municipal actors perceived their collaborations with different government agencies as smooth, especially when other government actors did not have to make financial contributions to projects.

All actors were generally aligned on desired outcomes when working on road freight projects. Most disagreements related to the *method* for completing projects and the *prioritization* of projects within the municipality or provincial governments' portfolios. Respondents perceived challenges in ensuring that all actors across levels prioritized road freight projects and allocated the staff and resources to completing them.

Respondents recommended a collaborative, regional approach to road freight. This entailed three elements. First, developing broad regional mandates that get stakeholders to the table and contribute to buy-in on projects. Second, collaboratively working with multiple stakeholders to identify regional priorities and work plans to realize them. Finally, increasing political and social permission to prioritize road freight. Respondents also recognized that adequate funding for road freight projects was necessary: strategic and regional priorities must be linked to funding from provincial and federal governments to see them through.

Effective collaboration also means having the internal capacity to build and maintain relationships over time. Many respondents highlighted that there are unclear accountabilities, poor communication, and staff turnover amongst themselves and their partners that makes it hard to see projects from the beginning to the end of their lifecycle. Collaboration is hard when partners change regularly and lack institutional knowledge.

As part of building capacity and advancing road freight decarbonization, respondents highlighted that there are a range of tools at their disposal. These include:

- Reallocating and optimizing the uses of existing industrial lands, road infrastructure, and analytical tools;
- Implementing eco-fiscal measures or pricing mechanisms for the use of the road by goods movement providers;

- Reframing how goods movement is understood and strategized by both professional staff and the general public;
- Developing provincial and Canada-wide goods movements strategies and accompanying funding envelopes; and
- Properly prioritizing road freight decarbonization.

In sum, all interviewed public sector staff were interested in advancing road freight decarbonization but recognized that it is neither a political nor a social priority that receives adequate resourcing, funding, or prioritization, nor currently has the perceived social or political license required to advance major actions. Plainly put, road freight is under considered by the public at large, political decision-makers, and mandates handed to public sector staff. Public staff also perceived a limited realm of influence given the private sector is the primary owner of the physical infrastructure associated with road freight.

4.3 Considering Public Perceptions of Government Actors in Road Freight

The social license to act is central to the job of urban planners and engineers. Without resident and political buy-in for housing, transportation, and energy projects, there would be little hope to chart a pathway to decarbonizing our economies, cities, and regions. As the climate crisis advances, building an informed and engaged public is vital to a democratic transition to a greener society.

Chapter 3 analysed and discussed the perceptions of 304 Canadians from Ontario, Quebec, New Brunswick, and Nova Scotia regarding perceptions of global warming, knowledge of government actions, government collaboration, trust in different levels of governments, and their perceptions of what levels of government should be involved in 10 road freight policies and interventions. The surveys were conducted within the broader context of:

- diminishing trust in government to respond to the climate crisis;
- a perception that policies do not reflect public input;
- and skepticism of government ability to deliver on services, policies, and actions.

Across Central and Eastern Canada, we found that there is a baseline concern that global warming is already impacting or will impact Canadians, their families, and communities. Canadians between 35 and 55 expressed the highest degree of concern with the lowest trust in government. Conversely, this age cohort had the greatest desire to see better cooperation and future efforts across government agencies.

Geographically, Ontarians had the lowest degree of trust in their governments on climate action, followed by Quebec, New Brunswick, and Nova Scotia. Within each province, the desire to see better government cooperation was greater amongst residents residing in urban areas, compared to respondents in suburban or rural areas.

In contrast to the literature on climate change and gender, we found that men and women equally wanted to see governments do more to combat global warming. There was a perception gap for both men and women between the tools that governments had to address global warming and their efforts. Both men and women wanted to see greater collaboration between agencies. We attribute this to the baseline level of concern for the climate crisis seen across Quebec, Ontario, and the Atlantic Provinces.

Proximity to energy infrastructure, highways, and industrial parks and logistics facilities were all found to impact one's belief in government action and trust. The finding that respondents who live near industrial parks and logistics facilities perceived themselves to have already been impacted by global warming was particularly significant. Such respondents also noted a desire to see better existing and future cooperation between government actors while doing more to address the climate crisis. This cohort of respondents had lower trust in governments to follow through on investing in their communities and the following through on policies.

There are six lessons that policymakers, planners, and politicians should takeaway from these findings:

1. There is a high-baseline level of worry about global warming in Central and Eastern Canada.

2. There is a desire to see greater cooperation between all levels of government (municipal, provincial, and federal) on climate action.

3. There is a lack of knowledge amongst Canadians on what actions governments are currently undertaking to address global warming.

4. There is a low level of trust in government follow through on actions that have been formally committed to.

5. The quality of cooperation between levels of government is perceived to be poor.

6. There is a perception that Canadian governments can do more for the climate.

Residents communicated a desire to see greater involvement of provincial governments and federal agencies in the implementation of road freight policies and interventions. There are many possible explanations for this. We propose that the most likely explanations result from an understanding that regional governments are needed to address regional problems: local governments do not have the tools or jurisdiction to govern at the regional scale or provincial scale. Respondents also signaled that it may be desirable to have multiple levels of government co-lead policies and interventions.

In sum, respondents want their governments to do more: greater action on climate change, and greater cross-agency collaboration. While trust is low, there is an opportunity to turn the desire to see greater climate action into a social license to advance road freight decarbonization. Meaningful engagement and the right mix of policies and actors will be key to governing road freight decarbonization.

4.4 Existing Conditions of Road Freight Governance in Central and Eastern Canada

This section describes the existing conditions of road freight governance in Central and Eastern Canada in response to Chapters 2 and 3. It outlines some of the key characteristics of the road freight system based on both resident perceptions and public staff inputs.

Road freight is a multi-scalar, multi-stakeholder system that is underusing its existing tools. Actors from the municipal scale up to the federal government are all implicated in critical components of road freight. Municipal governments collaborate with regional, provincial, and federal actors in governing and designing the road network, in directing industrial land uses, and in working directly with private sector actors. This work often happens in spite of a lack of legislated authorities to undertake regional work. Municipal actors often come together

willingly to govern regional matters that transcend city boundaries. Both provincial and federal actors also note regular touchpoints with other levels of government and the private sector. Despite having access to a suite of tools and funding mechanisms that exceed those downloaded to municipal actors, senior level government actors still feel constrained in how they act to govern road freight. Road freight is inherently regional in nature and requires consideration at all levels, from the site (warehouses and zoning by-laws) to the region (highways and road networks), and to the nation (safety and efficiency standards).

These perceived constraints have to do with the larger road freight ecosystem and the evolving nature of the public sector by extension. Public staff perceive there to be a limited role to play in road freight as advocates for good planning. Part of this role includes actively setting strategic priorities, establishing policies, and developing the regulatory framework for residents and the private sector to act in. In the course of our conversations with respondents, a clear dichotomy emerged between the private sector as “doers”, and the public sector as “referees” who ensure that private actors follow the rules. Such a narrative locks the public sector in a passive role that undermines their capacity to actively direct road freight governance for the better. It is true that Canadian governments are not responsible for running logistics operations on the ground. In adopting a passive role, they leave a range of mechanisms and tools on the table that can be deployed to push and pull private sector actors towards decarbonizing logistics practices. Without stronger government guidance, there is no guarantee that profit seeking corporations will act in the public interest.

Road freight is a critical part of cities and regions as it is connected to housing development, transit planning, and larger development patterns across Canada. As such, planning for road freight has a non-linear impact on the development of cities.

Residents and professionals want to see better collaboration between different levels of government. The passive role of the public sector is considered inadequate to the task of decarbonizing road freight. As seen in Chapter 3, residents in Central and Eastern Canada want better collaboration and involvement of all levels of government in taking climate action. Similarly, public sector staff also want to see greater collaboration between different government actors. This could take the form of data sharing and participating in regional bodies to properly address problems at scale. These actions require a degree of clarity over

accountabilities, the allocation of funding, and the prioritization of road freight actions all of which are absent in how road freight is currently governed.

Residents and professionals want to see greater provincial and federal involvement in governing road freight. Given the regional nature of goods movement, it follows that both residents and public sector actors tasked with governing road freight would want to see higher levels of government involvement. Residents in Central and Eastern Canada perceived the provincial and federal governments' roles in policies and interventions included coordinating logistics centres and industrial parks, integrating environmental data with zoning data, funding for academic and private sector research and deploying infrastructure, and developing codes for industrial and commercial construction (see Table 3.21 Respondent Proposed Distribution of Responsibilities). The desire to see governments co-lead efforts also signals a desire for greater collaboration: one order of government cannot manage road freight alone.

Public sector staff noted that road freight governance would benefit from the intervention of senior government via province-wide and nation-wide freight strategies, the prioritization of road freight, and the provision of corresponding funding.

The desire to see increased provincial and federal involvement highlights a lack of alignment between the existing distribution of powers to municipalities and the perceived ability to effectively govern road freight. The current governance of road freight is perceived by both public sector staff and residents in Central and Eastern Canada as lacking the right suite of accountabilities, strategic vision, and support to tackle its regional nature.

Road freight is poorly prioritized. There is a lack of alignment between the economic importance of road freight in Canada and how it is perceived by politicians and residents. In practice, road freight is found to have a low-profile amongst public staff who were interviewed. This results in an uphill battle to build political will and social license for new road freight initiatives. For example, implementing pricing mechanisms in road freight was deemed to have low political support. Residents are also concerned about the governments' abilities to manage the negative externalities of road freight. This is consistent with the general low degree of trust amongst residents in how Central and Eastern Canadian governments perform.

Another challenge that hinders road freight decarbonization is the lack of alignment between different government actors on *how* to prioritize regional projects. Given that road freight transcends conventional municipal and provincial boundaries, decarbonization projects can be perceived to fall outside the traditional portfolio of governments, limiting the funding and resourcing of such initiatives.

Building the case to prioritize road freight is perceived to involve educating and engaging with the general public to communicate why road freight infrastructure is important, while understanding and mitigating resident concerns. More broadly, there is a perceived need to shift the narrative and culture of road freight among professionals and the public. This includes not only thinking about the placement of logistics facilities across a city or region, but also labour market conditions, where housing is built, and where and how transit networks are developed. The proper prioritization of road freight ultimately benefits other sub-systems that serve residents across cities and regions.

There is inadequate effort and funding allocated to decarbonize road freight. Road freight and decarbonization are currently decoupled in professional practices across Central and Eastern Canada. Professionals often do not have projects that join up decarbonization initiatives and road freight. This is consistent with the general trend of road freight and industrial land uses being under considered (Kim et al., 2023; Alderneck, 2023). The lack of this coupling results in a corresponding lack of funding to support road freight decarbonization. The existing financing of decarbonization efforts is often piecemeal and lacks regional, provincial, or national strategies to guide the disbursement of funds.

In sum, Canada's road freight sub-system may be characterized as hard to decarbonize along political and social lines. Our findings demonstrate that there are social and political dimensions that serve as barriers to decarbonization alongside technical challenges to decarbonizing logistics operations, supply chains, and commercial electric vehicles. Road freight is underfunded, subject to unclear governmental accountabilities, and a low profile when considering its economic and social value. Road freight decarbonization requires a shift in how we govern the road, who is responsible for its composite parts, and how the general public is implicated in the sub-system's transition. There is also a need for clear objectives, values, and outcomes to steer these decarbonization efforts.

4.5 Reconfiguring Road Freight Governance in Central and Eastern Canada

Governance reform of road freight requires an approach that promotes better social dynamics while advancing decarbonization. Such an approach needs to explicitly couple road freight and decarbonization. Decarbonization cannot be a secondary consideration: it needs to be a critical component of the mission of all governments and non-governmental actors involved. There is precedence for this in the Government of Canada's whole of government approach to climate governance (Blue et al., 2022), and the idea of joined-up policy thinking (Agyeman, 2013; Koskal et al., 2021). The following section proposes avenues of governance reform that promote the coupling of road freight and decarbonization, foster greater inter-agency collaboration, and increase public engagement.

Changing Narratives Around Road Freight and Decarbonization

As noted earlier, social and political reasons make road freight harder to decarbonize. There are technical challenges to road freight decarbonization: the challenges of expanding grid capacity to accommodate electrification, developing reliable longer-range battery technologies, and finding the right mix of fuels as stop-gap measures while advancing electrification (Gross, 2020b). These challenges are solvable with a mix of the right policies, technological research and development, and funding (Harvey et al., 2018; Rissman et al., 2020)

Considering the decarbonization of road freight is about recognizing that academics, politicians, and bureaucrats are asking residents to consider the social dimensions of a climate transition. This is asking people to change their cultural attitudes and relationships to how road freight is operated, and what it means to live near road freight infrastructure. For example, it may involve shifting expectations about how quickly one receives deliveries (Nogueira, 2022), or how the benefits and nuisances of industrial parks are distributed (Fried et al., 2024). Addressing the social and political barriers that make road freight hard to decarbonize is about envisioning alternative climate and transportation futures that are different from the "business as usual" scenario that currently exists.

This is a tall order. Residents across North America have been exposed to decades of car-centric city and regional planning that has poorly allocated industrial development (Fried et al., 2024; Aderneck, 2023; Hatuka and Ben-Joseph, 2022). Our physical development

patterns reflect our disorganized governance structures, and vice-versa. The disorganized allocation of responsibilities and low perceptions of public sector capacities and abilities result in poor planning, and ultimately, poor industrial environments.

The public sector needs to play a key role in fostering new narratives of road freight. This entails building closer relationships with residents, communicating and assessing trade-offs and opportunities for road freight development, and building strong public sector capacity to plan and engineer a decarbonized transportation system. The symbolic and narrative dimensions of infrastructure—including transportation elements—are vital to facilitating decarbonization. As Buck (2019: 45) notes, “infrastructure inscribes cultural messages in the landscape; it expresses both authorship and authority”. Residents want their governments to be more proactive and collaborative in addressing climate change. At the same time, there is a low level of trust in government to follow through. Within this context, how do we find alternative ways of building infrastructure that are both responsive to the public good, and sensitive to the limits of public sector capacities?

Developing new narratives of road freight cannot happen from above. Future road freight narratives should be co-produced with residents and governments should work to build trust in the capacities and competencies of the public sector. Similarly, decarbonization targets, goals, and objectives will require negotiation and co-development between the public, public sector, and private sector.

4.6 Changing How Government-to-Government Collaboration Happens

A stronger, more competent public sector is key to building new narratives about road freight decarbonization. Decades of privatization have limited the knowledgebase and capacity of public sector actors (Mazzucato and Collington, 2023; Amatullo et al., 2022). We propose tools that can help foster stronger internal public sector capacity and intergovernmental collaboration on road freight decarbonization. In other words, we propose tools that may help the public sector in finding ways to *do more* regarding road freight.

Two key dynamics at play in road freight governance hinder decarbonization efforts. The first is the lack of provincial and federal involvement in regional matters that exceed municipal boundaries. The second is that municipalities are asked to tackle issues of importance that exceed their policy making and financial capacities as well as their geographic boundaries.

These issues can be addressed by reconsidering the allocation of responsibilities across municipal, provincial, and federal actors.

The Roles of Municipalities. Municipalities experience the downloading of responsibilities without an increase in funds and capacity. The result is that they are unable to manage their new responsibilities (McAllister, 2024; see Reeve, 2024 for an ongoing example of the consequences of downloading responsibilities in Alberta). As such, the role of municipalities should be elevated to account for their role in governing cities and regions. Two interventions of particular interest include the following two governance reforms (see McAllister, 2024: 51).

New regional governance structures that include municipal actors. These structures may include agreements between municipalities to pool resources, build capacity, and share knowledge to manage systems such as freight, transit, or environmental protections. This may also include greater clarity and reciprocity in relationships between municipalities and the provincial and federal governments. Regional governance structures for road freight would provide greater insight into the capacity, knowledge, and interest in road freight of different governmental actors. This avoids the duplication of tasks while building intergovernmental relationships. A clear outline of the governance structures and relationships could also clarify the roles of different actors and agencies planning regional road freight. As respondents in Chapter 2 noted, this could alleviate issues related to knowing who the right people to work with are, provided that such governance structures establish robust relationships and a clear outline of what agencies and actors will be responsible for regional planning of freight.

Increased visibility and involvement in provincial planning and policymaking. Municipalities often exercise the will of provincial policymakers. There is an opportunity to provide municipal actors with the capacity to influence how policies will be shaped before they are imposed on municipalities. This provides the benefit of the localized knowledge that the principle of subsidiarity promises while still “thinking” at the regional scale (Wolf, 2001). Subsidiarity is the principle that “decision-making authority is best placed (a) where responsibility for outcomes will occur; and (b) in the closest appropriate proximity to where the actions will be taken” (Wolf, 2001). Municipal involvement in provincial policymaking could take the form of formal working groups and agreements to collaborate, or more informal relationships and engagements on policy as it moves through its development at the provincial level.

Regardless of the specific interventions, it is important that any future road freight governance reform recognizes the regional-scale role that municipalities already play and provide them with the tools to better address the challenges facing road freight decarbonization. This may also include expanding the abilities of municipalities to raise funds or impose eco-fiscal measures that contribute to the decarbonization of road freight.

The Roles of Provincial Governments. Both public sector respondents and residents noted a desire for greater provincial involvement in road freight. This could take the form of dedicated road freight strategies and funds at the provincial level that are reliable, long-term, and empower local governments to meet the challenges they face. Not only could some responsibilities that are regional in nature be uploaded from municipalities (e.g., monitoring of environmental data; regional industrial land strategies, etc.), but provincial governments should also take a direct role in shaping decarbonization targets for road freight. Without greater provincial involvement with road freight, there can be no consistency in how lower levels of government manage road freight decarbonization regionally.

This is also an opportunity to enjoin road freight and decarbonization at the provincial scale. Quebec has already taken some initiative in developing a regional *Sustainable Mobility Policy – 2030* for Road Freight Transportation that serves as an example of what such a provincial plan could look like. The *2030 Policy* includes measures that fall under identified road freight issues and the relevant indicators and targets for each measure.

Provincial governments could provide greater leniency in allowing municipal governments to govern regions by coalition or in establishing new governance structures. Currently, provinces legislate regional governments and agencies (such as Upper Tier Municipalities in Ontario, the MRCs in Quebec, and the JRTA in Nova Scotia). A future governance system may consider the ability of municipalities to come together and develop regional agencies to manage road freight.

Provincial governments have the opportunity to work more closely with the federal government on road freight decarbonization. This could entail engaging in joint research initiatives, funding opportunities for academic and private-sector actors, and co-leading the implementation of policies.

Finally, the provincial government should provide dedicated funding to road freight initiatives that address decarbonization. Without dedicated funding, policies are just words on the page: lifeless and ineffective.

The Roles of the Federal Government. The federal government's outlook is already national in nature. This provides an opportunity to think holistically about the governance of road freight. The federal government is already responsible for inter-provincial and international trade and setting efficiency standards, and so it already has the apparatus to develop tools to support road freight decarbonization. One of the critical roles that the federal government could play would be to develop national road freight strategies, values, objectives, and priorities. Such strategies may also be accompanied by funding that ensures they can be implemented, with regular public communications about the progress on meeting their objectives and what work should follow. Some of the federal government's expertise in rail and marine freight may also be transferable to developing road freight decarbonization strategies. The federal government may also take a similar approach to relationships with provincial governments for road freight; namely, providing dedicated funding to provincial bodies with conditions stipulated.

4.7 Tools to Support Reformed Road Freight Governance

There are three tools that can help reform the roles in road freight governance. These tools are intended to enhance characteristics of good governance: agency, capacity, transparency, public accountability, and political will (McAllister, 2024: 6).

Freight Forums: Regional Collaboration Mechanisms. There are two primary types of freight forums of interest here. First, there are events that convene government actors, the private sector, and non-government actors, academics, and the general public to speak about the challenges and opportunities of goods movement for a given region.

In the United States, a form of freight forum or working group is somewhat formalized within Metropolitan Planning Organizations (MPOs). An MPO is a transportation planning organization that is often responsible for goods movement at the regional scale. Schank et al. (2008: 13) note that MPOs sometimes have stakeholder groups or committees that are "voluntary and unrestricted" in their memberships and may include everyone from freight operators to the general public, though these groups are mostly comprised of "members from

within the freight community". The benefit of an MPO is that it may house a permanent or recurring governing body for managing the planning and strategic outlook of freight for a region based on population density and urbanized areas rather than municipal boundaries (FHA, 2017: 3–25). How they are governed varies from one locale to the next, allowing for a range of governing structures that best suit a given context. For example, MPOs may be fully independent governing bodies, or hosted within another regional government agency, or some configuration in between. Their organizational structure is responsive to a region's context (FHA, 2017).

Within this organizational structure, a freight forum or working group provides the opportunity for multiple segments of stakeholders to collaborate or discuss emergent issues with each other, allowing for "these committees [to] form the backbone of the freight planning operations of the MPOs" (Schank et al., 2008: 12). The presence of a freight forum or working group can help develop a stronger sense of public accountability by directly involving members of the public. It also serves to raise the profile of road freight with political officials and bureaucrats who may choose to represent their agencies or regions on the forum. Greater interaction between "state and local authorities" also helps to build public sector capacity and knowledge transfer amongst staff involved by providing a context to co-develop or coordinate plans (Schank et al., 2008: 11–12).

An example is the New York State Association of Metropolitan Planning Organizations (NYSAMPO), which is an "information sharing organization" that involves the fourteen MPOs in New York State (NYSAMPO, 2024). The NYSAMPO explicitly defined knowledge transfer between actors, integration of planning practices across scales, and stakeholder outreach as core goals of their freight working group, signaling the importance of a state-wide approach to goods movement (see NYSAMPO's *2024 – 2025 Working Groups Work Program*).

A local, emergent example of the successes of freight forums is the Durham Region's 2022 two-day *Durham Region Freight and Goods Movement Forum* that sought to explore both "big picture" goods movement considerations and the local freight context. Durham Region's forum (IBI Group and Kriger, 2022: 1):

> was conceived as a way to initiate meaningful and constructive dialogue with different interest groups and participants across the goods movement spectrum on goods movement trends,

> needs, issues, best practices and opportunities. The forum would provide the valuable opportunity for different interest groups to hear each other's needs, realities, aspirations, and how they make their decisions.

Such an approach allows for greater transparency in explaining how freight decisions are made, while developing members' capacity. Two key recommendations of the forum were to "enhance the profile of the transportation and logistics sector" and "collaborate", with the latter highlighting that "industry-government dialogue and mutual understanding are key to the successful development and implementation of a goods movement strategy" (IBI Group and Kriger, 2022: vi).

Such freight forums and collaborative mechanisms are not uniformly implemented in North America, even within the organizational structure of MPOs (Schank et al., 2008). There is room to further implement points of engagement and collaboration between public sector actors, the private sector, and residents.

Provincial or National Freight Agencies. MPOs are an example of regional transportation agencies that are responsible for freight planning. Beyond the idea of MPOs, however, are larger questions regarding the degree to which the public sector is implicated in the planning and operations of freight. As previously discussed, road freight is generally "done" by the private sector (see Monios, 2019 for a British case study of private sector freight provision), with the public sector acting as referees, or setting the parameters for operators. Part of this is by virtue of who manages and owns key assets associated with road freight: warehouses are primarily owned or leased by private operators.

The benefit of centralized regional- or national-scale agencies is seen in their potential to share knowledge across a broader geographic area while building out public capacity and agency. For example, public transportation is often governed by agencies that are independent of any single municipal government, while also being at an arm's length from provincial actors. If multiple municipalities within their service area want to develop infrastructure or transit plans, they can rely on the expertise and capacity of their regional transit agency.

A similar model may work well for road freight, though such a model does not *prima facie* remove challenges of managing complex intergovernmental tensions that arise from multi-

stakeholder infrastructure projects. An example of a successful nation-wide agency is *Rete Ferroviaria Italiana* (RFI), the owner and developer of Italy's railway infrastructure. As the managers of railway capacity, maintenance and development of existing and new infrastructure, and traffic-control management nationally, they have broad knowledge of their operations that make them suitable to develop new infrastructure across Italy (Mingrino, 2010). The benefit of this is that local projects do not need to develop new capacities to be successful, instead relying on the existing wealth of knowledge that RFI possesses (see Levy, 2021). Italy has lower costs related to transit infrastructure as a result of strong public sector knowledge and capacity (Levy, 2021: 13).

What might this look like for road freight in Canada? Recall that ownership and responsibilities for roads in Canada is distributed across multiple jurisdictions, though road users experience a single network. Consolidating the management of public roads under a single body or a network of regional/provincial bodies can allow for uniform implementation policies that include curb-side management and pricing/eco-fiscal measures. Such an approach can concentrate funding envelopes and strategic objectives. If properly funded and supported, regional governance can also help to build a storehouse of knowledge that lower levels of government can access when road freight questions arise, diminishing some of the public sector's reliance on consultant expertise. This contributes to building out public sector capacity and agency.

This approach may also contribute to clarifying the accountabilities for road freight. Transit is instructive for how road freight may develop regional governance approaches in the future. There has been a push for greater provincial involvement and oversight in the development of transit infrastructure in Quebec (Laberge, 2024), Nova Scotia (JRTA, 2024), and British Columbia (see Province of British Columbia, 2024). This has taken the form of either dedicated provincial or regional agencies, or targeted transportation policies that apply province wide. A dedicated wing of the government or a provincial department for goods movement would be especially instructive.

Citizens' Assemblies: Involving Residents in Planning Road Freight. Meaningful public engagement is needed to advance road freight decarbonization. Citizens' assemblies are one mechanism aimed at institutionalizing greater resident involvement in policy development. A citizens' assembly takes a random but representative group of residents to deliberate on

matters of importance, such as electoral reform (Fournier et al., 2011) and climate action (Muradova et al., 2020). As Saitō (2024: 134–135) describes,

> Experts give lectures addressed to these assemblies, after which debates take place between members, and in the end, consensus across the membership is measured by vote…What the creation of the citizens' assemblies show us is that the social movement can renovate democratic processes and use the power of the state without sliding into "climate Maoism" [authoritarian and top-down climate decision-making]."

The benefit of a citizens' assembly is the convening of residents for the purpose of deliberating on a matter of importance, as well as providing the space to educate those involved (Rose, 2009). The desired outcome is an informed and thoughtful recommendation on policy matters that comes *from residents* and is reflective of their will (Saitō, 2024; Rose, 2009). In practice, early Canadian citizens' assemblies in British Columbia and Ontario did not result in tangible policy transformations (Rose, 2009). Their value to this research is providing a framework for imagining how residents can be educated on complex policy matters while embedded in the decision-making process. This could contribute to building a stronger sense of transparency and public accountability into how freight decisions are made, as well as raising the general knowledge base of residents. Moreover, a more educated public may help pressure politicians to act on climate, compelling political will amongst decision-makers. This is particularly valuable as both residents and public sector staff feel as though there is insufficient general knowledge of road freight, and that this leads to worse outcomes.

Implicit in such an approach to engagement is the sense that residents have insights that are valuable to politicians and policymakers, and that they have a capability[24] to learn and interpret new information. Buck (2024) notes that engagement needs to involve "the hard work of listening to people and learning from them. We have to put resources into a different sort of public engagement with climate change, one that sees publics as competent and nuanced rather than as susceptible marks for memes."

[24] Throughout this thesis, the term capacity has been used in reference to public agencies, their staff, and their actions. When speaking of residents, we have opted to use the term capability. Capabilities may be understood as part of what defines a person's ability to live a flourishing and free life. To this end, further developing one's capabilities would allow one to develop their ability to achieve well-being (see Agyeman, 2013: 25 – 26 speaking on Sen, 1999, Schlosberg 2007, and Schlosberg and Carruthers, 2010).

Part of building new narratives of road freight and tackling the climate crisis involves assuming that residents are capable of understanding the complexities of projects that happen within and near their communities. It is not so much that residents cannot understand, but rather that they lack the knowledge of how and why decision making happens. As discussed in Chapter 3, when residents do not perceive a process to be fair and transparent, there are lower levels of trust in government. To this end, citizens' assemblies can not only result in consensus around policy recommendations, but they have the potential to transform their participants. As Nakagawa and Ehsassi (2023) argue:

> Learning, deliberating, developing a sense of voice and working for common causes across differences can inspire apathetic and cynical people to engage, to become informed and socially connected, to enthusiastically participate in politics, and to have a sense of meaningful input in the governance of issues that are consequential to them.

We can imagine an emerging regional governance system where citizens' assemblies play a vital role in setting objectives, proposing concrete policies, and empowering residents to be involved in their communities. Such an approach to engagement may work to build trust in government given that residents become a part of the process, not just actors who have one or two engagement touchpoints during the process of developing a regional plan or strategic plan. In the same spirit, participatory budgeting has been implemented as a means of implicating residents in the process of selecting projects and programs to fund and by extension, providing a greater opportunity to impact city-building (Flynn, 2016).

4.8 Towards a Taxonomy of a Decarbonized Road Freight Governance System

In light of the above, it is valuable to lay out a proposed taxonomy of powers, responsibilities, and capacities that actors should have in governing the road freight system. Table 4.1 Allocation of Powers, Responsibilities, and Capacities proposes some of the powers, responsibilities, and capacities that the different levels of government, the private sector, and the general public should possess to successfully decarbonize road freight.

Table 4.1 Allocation of Powers, Responsibilities, and Capacities

Actors	Powers	Responsibilities	Capacities
Municipal Government	• Greater involvement in regional and provincial policy development • Stronger powers to implement eco-fiscal measures • Stronger influence in regional decision-making • Green procurement policies	• Act on behalf of public interest • Substantive engagement with residents • Substantive partnerships with provincial and federal partners • Substantive engagement with private actors • Develop and foster technical knowledge of road-freight	• Increased financial capacity to implement road-freight decarbonization measures • Greater authority to implement eco-fiscal measures and alternative funding mechanisms • Increased ability to collaborate with partners • Greater knowledgebase of road-freight • Greater capacity to meaningfully engage residents
Provincial Government	• Delegation and downloading of powers • Implementation of policies and legislation • Fund strategies and policy implementation • Green procurement policies	• Act on behalf of the public interest • Substantive engagement with residents • Co-lead the implementation of policies and strategies with municipal and federal partners • Engagement with private sector actors • Develop and foster technical knowledge of road-freight	• Increased ability to collaborate with partners • Greater knowledgebase of road-freight • Greater ability to delegate authorities and share power • Greater capacity to meaningfully engage residents
Federal Government	• Delegation and downloading of powers • Financial support • Implementation of policies and legislation • Fund strategies and policy implementation • Green procurement policies	• Act on behalf of the public interest • Substantive engagement with residents • Substantive partnerships with municipal and federal partners • Engagement with private sector actors • Develop and foster technical knowledge of road-freight	• Increased ability to collaborate with partners • Greater knowledgebase of road-freight • Greater ability to delegate authorities and share power
Private Sector	• Lobbying • Research and development • Respond to market signals • React to legislation, policies, and regulations	• Revenue generation • Accountability to shareholders • Accountability to consumers • Pay appropriate fees for use of public infrastructure and research	• Greater capacity to act in the public interest
General Public	• Provide recommendations on climate and transportation policy • Advocacy on areas on climate and transportation policy	• Hold public and private sector actors accountable • Meaningfully engage with public sector actors • Articulate and help to define the public interest • Gain knowledge of climate and transportation initiatives and systems	• Greater knowledgebase of road-freight • Greater ability to engage on climate action

The content of this taxonomy is intended to address some of the “hard to decarbonize” elements of road freight: building the social license to act and managing the complexity of Canada’s multi-jurisdictional system. It is valuable to note that the purpose of this taxonomy is not prescribe specific government actions. Instead, it is intended to provide a flexible set of recommendations for how a government agency or group of government agencies approach road freight decarbonization, and what would be expected of different actors. There will always be challenges associated with multi-level governance systems and their respective actors, especially around contentious issues such as infrastructure development and transportation. As different political parties and governments tend to have conflicting priorities when it comes to infrastructure (see Doern et al., 2021), one should interpret this taxonomy as providing a framework to build future agencies and relationships between actors. As such, the powers, responsibilities, and capacities outlined do not need to be adopted wholesale – actors and agencies may select different elements as they work for the particular political, social, and economic context. Moreover, different elements within the taxonomy may be accomplished without inputs or with minimal input from other actors (e.g., different actors can enrich their

baseline knowledge of road freight). With this in mind, there are two critical assumptions that are built into this taxonomy. These include:

Strengthen Capacities to Engage. This assumes broader and strengthened capacities within the public sector to engage with each other, and with residents. Conversely, residents are assumed to have a responsibility to meaningfully engage with their governments, while holding them (and the private sector) accountable for their in/actions on climate and transportation. This may help heal what Glavovic et al. (2021: 829) characterize as the broken "science-society contract". This is no easy task. It means building a narrative of shared and intertwined responsibility between government and residents that is currently fractured. Buck (2021: 178) notes, "communities will need to see public benefit from these infrastructures and projects in order to get them built". Building public support for decarbonization requires all levels of government to develop new strategies to communicate risks, opportunities, and trade-offs that come from decarbonizing road freight. This includes being explicit about the trade-offs that come from doing nothing to address climate change—something that is often poorly communicated or not communicated at all to residents (ICLEI Canada, 2022).

It is understandable that decarbonizing the transportation system at large has residents uncertain and worried. Decarbonization, as we have argued, is not just a technical transformation, but a social and political one too. Overcoming challenges to building social license for decarbonization means addressing worries about job security (Eaton, 2024), about what say people have about the future (Buck, 2021), and about the aesthetic and physical dimensions of people's communities that come from industrial development (Hughes, 2021. Concerted efforts will be needed in the public sector to better understand road freight, as well as amongst the general public. As Buck (2021: 181) poignantly writes:

> Everyone can participate in phaseout, because the work here is largely cultural, empathetic, and relational. It includes listening and creating new stories about retreat and ending and change. We already know how to execute a controlled demolition of fossil fuels, from a technical standpoint. There will be more roadmaps published; more scenarios, projections, and Geographic Information Systems analysis drawn up; more report launches and webinars. What we have to do is continue to make winding down fossil fuels mainstream, common sense – but not just among technocrats and the policy elite. We have to also help one another understand it as an opportunity.

Technical interventions and analysis will be necessary for any climate transition. However, they cannot shadow the necessary and transformative work of changing our relationships with the planet, politics, and our communities. Unless there are substantive efforts to embed residents in the process of decarbonizing road freight—including changing the structural relationship governments have to residents—building a strong social license to act will remain challenging. In spite of the general support for climate action, residents want to feel as though their governments are acting in ways that are fair and responsive to their needs. Connecting climate action to residents' needs is something that is challenging within the context of how planners, engineers, and politicians currently operate (Jesuit, 2014; Hochachka et al., 2022). A new approach will require the development of new capacities (Buck, 2021).

Power sharing: reallocating the responsibilities of road freight across the municipal, provincial, and federal governments. This taxonomy assumes that the federal and provincial governments will need to be more comfortable with power sharing, as well as with providing adequate funding to municipalities to act on climate and transportation. This is perhaps the most significant political barrier to decarbonizing road freight, as it presumes significant legal reforms to Canada's *Constitution*, and by extension how heads of power are governed and delegated amongst all three levels of government (Benidickson, 2019).

Some of the ambiguities of how transportation and the environment are currently governed come from the fact that all levels of government are capable of passing legislation related to transportation and the environment, though the powers to fund and enforce policies is lacking for municipalities. This results in a system where multi-stakeholder agreements are required to complete major infrastructure projects, especially those spearheaded by municipalities. Under our proposed taxonomy, the federal and provincial government would need to develop the *capacity* to share and allocate powers to municipalities.

An example of the allocation of powers in practice are through the "Strong Mayor" powers of municipalities in Ontario. Strong Mayor powers allow municipalities to implement and advance provincial priorities. Some of these powers relate to provincial legislation that include "building 1.5 million new homes by December 31, 2031" and "constructing and maintaining infrastructure to support housing, including: transit, roads, utilities, [and] servicing", among other administrative powers (Government of Ontario, 2024). However, the larger political environment in Ontario makes it so that there are frequent provincially directed reforms to

planning legislation, leading to greater uncertainty for municipal actors (Hushion et al., 2024: 8).

It is valuable to consider what this capacity to share power might look like. For one, it would require all levels of government to be mission-oriented: to focus their efforts and capacity-building on responding to societal “grand challenges” with the aim of giving “explicit technological and sectoral directions” to solve them (Mazzucato, 2017: 3, 8). In this case, the grand challenge is climate change, and by extension, road freight decarbonization. By focusing on selected priorities, the focus is shifted away from wielding power for its own sake and instead to orienting government agencies towards achieving their stated missions. Acting to tackle climate change may be framed as both a mission of the public sector and as a public good. As Mazzucato (2024: 17) notes “putting the common good at the heart of governance empowers and encourages governments, business, and civil society to actively shape markets and to incorporate public value into the coordination required to meet common objectives”.

Second, such a mission-oriented, cross-jurisdictional approach would require rethinking how responsibilities and powers are allocated: it would mean building off of the strengths and capacities of different actors to mitigate the climate crisis. While a formal accounting of relationships between the municipal, provincial, and federal government is still needed, the focus should not be on the minutiae of delegated powers and who is responsible for what. Recent municipal-provincial tensions on transit funding and provincial-federal tensions on healthcare demonstrate the limitations of trying to combatively negotiate the contours of responsibilities to act (Harrold, 2024; Scherer, 2022). Neither transit nor healthcare are serving residents better than before such tensions (French et al., 2024; Tasker, 2024). These jurisdictional conflicts point to structural problems that may be solved by re-framing and re-considering how we govern our infrastructure. The pressing questions we should be asking of our ways of governing are: How do we collaborate to address our most pressing issues? How do we allocate resources to ensure the largest public benefit?

While there are some discussions about changes to municipal-provincial relationships (Hauen, 2024), legal reform of Canada’s *Constitution* will remain challenging for many reasons, including the historical failure to implement constitutional amendments, the lack of political will amongst provinces to change existing power structures, and the legal structure

established to bring forward amendments (Albert, 2015). As Albert (2015: 97, emphasis mine) notes:

> Many though not all of these extra-textual rules for formally amending the Constitution of Canada trace their impetus to legitimate concerns for protecting minority rights in connection with Quebec. When layered onto the existing formal amendment rules, these additional non-textual rules may well make major constitutional *amendment impossible today in Canada.*

This, perhaps, is the most significant reason that road freight is hard to decarbonize: there are historical structures that govern how we cooperate and collaborate that limit the field of possibility for actors such as municipalities and regional governments. Without significant formal changes to how we fund transportation, how provinces are involved, and the role of the federal government, piecemeal interventions will prevail. The tools we proposed above are possible avenues to advance road freight decarbonization within the socio-cultural, legal constraints. Better collaboration between agencies and resident engagement can both begin without waiting for legal transformation. Just because road freight is hard to decarbonize does not mean that we should not keep trying.

4.9 Conclusion

This chapter has provided an overview of the social dynamics of road freight in Central and Eastern Canada. Based on interviews with professionals from Chapter 2, and the results of resident surveys in Chapter 3, we have sketched out some of the existing conditions of the road freight system, focusing on the challenges to good governance that actors face. These challenges include that:

- Road freight is a multi-scalar, multi-stakeholder system that is underusing its existing tools.
- Residents and professionals want to see better collaboration between different levels of government.
- Residents and professionals want to see greater provincial and federal involvement in governing road freight.

- Road freight is poorly prioritized by government staff and political actors
- Road freight decarbonization is not allocated the effort and funding it requires.

Addressing these challenges requires developing new social narratives concerning road freight and decarbonization, changing how governments collaborate with each other, and developing tools for reform. These tools include new regional and national agencies, the implementation of citizens' assemblies, and the widespread adoption of freight forums and other engagement tools.

We conclude by proposing a new taxonomy of powers, responsibilities, and capacities for the road freight system in Canada. In focusing on elements that make road freight socially and politically hard to decarbonize, we sought to highlight that it is possible to transform how the public sector cooperates and collaborates, though larger structural changes may be out of the question in the short- to medium-term. In spite of the challenges to larger constitutional reform that would reconfigure how different levels of government interact and collaborate with each other, the time to act on climate change is now. We have proposed a range of tools that may be implemented in the short to medium term without relying on legal reform. While better and more frequent collaboration may be difficult given how Canada's jurisdictions compete for resources and power, being mission-oriented and acting in the public interest may be ways to push us towards new and improved social dynamics in governing road freight.

CONCLUSION AND RECOMMENDATIONS

This thesis is a first step in developing a multi-disciplinary area of study: the social dynamics of road freight, with an embedded focus on decarbonization. Where previous research has largely focused on the technical aspects of decarbonizing road freight, this thesis has argued that it is essential for researchers and planning practitioners to explore how governance structures can contribute to coupling road freight mandates with decarbonization mandates. We argue that all future Canadian road freight initiatives should centrally consider broader decarbonization goals. As we heard from professionals, road freight and decarbonization are decoupled. This thesis is a first step in laying the groundwork for joining up road freight and decarbonization.

The social dynamics of road freight is the study of one subsystem of Canada's broader transportation system. As we've argued, there are vital roles for government, the private sector, and residents in shaping goods movement. Our focus has primarily been on the role of the public sector in these social dynamics, as trust in government and the capacity of staff are at a historically low moment. As such, there are fertile grounds for the public sector to empower itself and residents in forging ahead with a mission-oriented, citizen-involved approach to decarbonization.

The overall argument that we've made throughout this thesis is as follows:

Public sector staff play the role of referees for the private sector, who are the operators and "doers" of road freight. This relationship has resulted in the public sector leaving policies, funding mechanisms, and other tools on the table that could help advance road freight. The perception of the public sector as setting the limits of appropriate action has resulted in a lack of necessary action to mitigate climate change. To some degree, this situation is structural: the formal division of powers in Canada and the delegation of authorities has resulted in a lack of clarity on roles, responsibilities, and insufficient funding allocated to road freight initiatives. The relationships between municipalities, provinces, and federal governments are many to many, and distinct across each province and region. The resulting fragmentation of roles and responsibilities has resulted in a governance context where road freight and decarbonization are neither prioritized, nor the focus of any level of government's mandate.

Instead, road freight is governed across agencies, and even across departments within each agency.

Professional planners and engineers want to see road freight decarbonized and perceive great advantages to multi-jurisdictional collaboration. While overall inter-jurisdictional work is smooth, public staff struggle to consistently collaborate with other levels of government to implement road freight measures, let alone decarbonization measures. Where challenges arise is over *how* to accomplish better road freight outcomes—there is general agreement about outcomes, but not about how to meet them. Other challenges that make collaboration hard include low public sector capacity, the challenge of getting multiple actors to prioritize regional matters outside their immediate portfolios, and a lack of dedicated funding.

Residents are perceived by public sector staff to play an important role in building the case for public efforts to decarbonize road freight. However, residents' general lack of knowledge and worries about the negative effects of living near goods movement facilities and infrastructure have resulted in a perceived NIMBY attitude that limits the social license for the public sector to act. This is compounded by the low degree of trust that residents have in their governments in taking action to mitigate climate change. There is the general sense amongst residents that better collaboration is needed between all levels of government, and that the public sector needs to be doing more, with better tools. Residents also want to see senior levels of government—their provinces and the federal government—stepping to lead or co-lead road freight interventions and policies.

In light of this, we have a situation where both public sector staff and residents want better intergovernmental collaboration and greater efforts on climate action. To accomplish this, we recommend:

- A reallocation of the powers and responsibilities for all levels of government, the private sector, and residents. This should include a necessary call to develop the capacities of all actors. We all need to learn and work together to change our narratives around goods movement and climate change. This is perhaps the most challenging measure to implement. Tensions are rising between municipalities, provincial governments and the federal government over funding and the delegation or uploading of powers Where things land is to be determined, though it is unlikely municipalities will be given greater powers in our current governance landscape. Without a greater

sense of unity and collaboration, our narratives of climate transition risk being as fragmented as our governance systems.

- The implementation of better collaboration mechanisms and tools. In some cases, all it will take is empowering governments to use the tools they already have more effectively. In other cases, we propose the introduction of new tools and mechanisms, including regional and provincial freight agencies and freight forums.

- A reconsideration of the role that residents play in road freight planning, and city-building more generally. There is a need to heal the fractured "science-society" contract and build stronger trust between government actors and residents. This can start with working from the assumption that residents have a vested interest in and care for their communities and environments. The public sector has a responsibility to educate the public, while the public has a responsibility to build up their capability to learn and engage on wicked problems. The outcome of better government-resident relations is a greater social license to act, and thus, a more aggressive approach to the climate crisis.

In an environment where the public sector is resource constrained and lacks knowledge and capacity, we recommend a few guiding principles for decarbonizing road freight:

Practice joined-up thinking. Climate policy is transportation policy, and transportation policy is climate policy. While both domains are often treated as related but distinct, joining both can help to address multiple problems while saving time, effort, and resources. Thinking systematically about how we regulate, develop, and maintain our regions can help ensure that actors are working in concert with each other. With the right governance configuration and tools, it may also mean building on the expertise and capacities of all actors while avoiding a duplication of tasks.

Learn from others. No one actor has all the answers on how to decarbonize road freight. Addressing a problem as wicked as climate change will require calling in a range of actors and stakeholders. The public sector should focus on learning from each other, both from neighbouring governments and from national and international actors. Residents also have a lot to learn about how their cities and regions work. Planners have done a poor job of explaining the risks, opportunities, and trade-offs of taking and not taking climate change

seriously. In meaningfully engaging residents, planners can begin to build the social license to decarbonize road freight.

Focus on the social dimensions of decarbonization. We will need technological innovations to advance decarbonization. We cannot reduce the carbon emissions from freight without modal shifts to rail, better and more durable battery technology, a greener energy grid, and intelligent freight systems. Decarbonization is not just about technology, however. When we speak about decarbonization, we are speaking about a radical transformation to our everyday lives: how we travel, how we receive and shop for goods, and what the future of our regions will look like. Focusing on the social dimensions of decarbonization is about walking hand in hand with others in imagining a future that is equitable, intentional, and respectful of planetary limits. People have legitimate concerns about what the climate transition will look like. A failure to engage residents on the challenges and opportunities of this transition risks disenchanting the public and stalling necessary climate action.

The road to decarbonizing goods movement will be difficult. With the rise of populism in North America, climate policies will continue to face greater scrutiny and skepticism. Now more than ever, we need a strong public sector and an engaged and informed public to work together to combat climate change. Road freight is certainly hard to decarbonize for technological, social, and political reasons. The hope is that the study of its social dynamics can contribute to making it a little easier to decarbonize road freight.

Research Limitations

This research has relied on two datasets: a series of 11 interviews with public sector professionals, and the survey results from 304 representative Canadians in Ontario, Quebec, Nova Scotia, and New Brunswick. While both datasets have been appropriate for the scope and size of this thesis, they limit the ability to generalize the findings discussed. The focus on Central and Eastern Canada is also responsive to the particularities of the region. As such, further studies should explore the social dynamics of road freight in other parts of Canada and the United States. Given the energy politics and socio-political dimensions of climate change in Alberta, it would be particularly instructive to study the social dynamics of road freight in the Prairies.

This thesis has focused on the role of the public sector in governing road freight, along with their relationship to the public at large. Future studies should explore the dynamics between the public and private sectors, as well as how road freight operators interact with and relate to residents across Canada.

Future Directions for Research

There are multiple avenues of continuation for this research. Three of these include:

Studies on the dynamics between different actors of the road freight system. Using the social dynamics approach we have proposed, future work can focus on understanding how the perspectives of different actors within the road freight subsystem impacts the efficacy of governing goods movement. Some specific relationships to study may include:

- The dynamics between goods movement operators and public sector staff;
- The dynamics between environmental and transportation not-for-profits and public sector staff; and
- The dynamics between residents and goods movement operators.

It is expected that this work would require a mixed-methods approach that includes focus groups, interviews with key actors, and surveys of representative groups. Ethnographic work may be required in instances where interactions between private operators or public sector staff and residents are to be studied (e.g., by attending public consultations or open houses for projects).

Studies on how road freight operators engage (or fail to) with residents across Canada. As noted by Walker and Baxter (2017) and Fried et al. (2023), the degree of engagement on major infrastructure projects is often minimal, or lacks real or perceived procedural fairness. As such, future studies should explore how the presence or lack thereof of engagement on road freight projects impact their social license. As the majority of road freight projects are led by private operators, this would most likely entail a study of what projects (if any) have seen the private sector engaging residents near the development of logistics facilities. This may also look at what impact not-for-profits who work on transport equity and environmental justice have on the site selection process. A future study may include a comparison between the social acceptability of a logistics project that involved local residents, and one that did not.

Studies of the social dynamics of road freight in different geographic regions. This thesis explored the social dynamics of road freight in Central and Eastern Canada, a region that is largely homogenous in its belief in climate change, and does not have the highest concentration of fossil fuel jobs relative to other parts of Canada. It would be valuable to understand how different political and social contexts impact resident perceptions of and public sector staff efforts to decarbonize road freight. One particularly insightful case may be to contrast the work of this thesis with a study of the social dynamics of road freight in Alberta and British Columbia. The energy politics in both places are starkly different from Central and Eastern Canada (and in some cases, from each other), and would be instructive in understanding how the public sector, private sector, and residents interact with, and shape the road freight subsystem.

APPENDIX I

CHAPTER 3 AND 4 GENERAL POPULATION SURVEY (ENGLISH AND FRENCH)

General Population Survey (English)

Canada has committed to meeting international climate targets under the Paris Agreement. Each province and many municipalities have also committed to additional climate targets to mitigate global warming. The purpose of this survey is to collect information and understand Canadian perceptions on how their governments are responding to global warming and the development of new infrastructure, and in particular, transportation infrastructure, to support this response.

This survey is open to residents of Ontario, Quebec, New Brunswick, and Nova Scotia.

PART 1: SOCIODEMOGRAPHIC QUESTIONS

In what province do you currently reside?

a) Ontario
b) Quebec
c) New Brunswick
d) Nova Scotia
e) I reside in another province or outside of Canada.

If e) is selected, redirect the participant to a screen thanking them for their time that notes they are not eligible to complete this survey.

Do you work for the federal government, provincial government, a regional government agency, or municipal government?

a) Yes
b) No

If the answer is yes, redirect the participant to a screen thanking them for their time that notes they are not eligible to complete this survey.

How old are you?

a) 18 – 24
b) 25 – 30
c) 31 – 35
d) 36 – 40
e) 40 – 45
f) 50 – 55
g) 60 – 65
h) 70 – 75
i) 75 years or more
j) Prefer not to respond

What gender do you identify with? Please select all that apply.

a. Male
b. Female
c. Transgender
d. Non-binary
e. Specify, if desired
f. Prefer not to respond

What language do you most commonly speak at home?

a. French
b. English
c. Other, specify if desired
d. Prefer not to respond

How would you describe your ethnic origins? Please select all that apply.

a) Black (e.g., African, African Canadian, Afro-Caribbean descent)
b) East Asian (e.g., Chinese, Japanese, Korean, Taiwanese descent)
c) Indigenous (e.g., First nations, Inuk/Inuit, Métis descent)
d) Latin American (e.g., Hispanic, or Latin American descent)
e) Middle Eastern (e.g., Arab, Persian, West Asian descent (e.g., Afghan, Egyptian, Iranian, Kurdish, Lebanese, Turkish)
f) South Asian (e.g., Bangladeshi, Indian, Indo-Caribbean, Pakistani, Sri Lankan)
g) Southeast Asian (e.g., Cambodian, Filipino, Indonesian, Thai, Vietnamese, or other Southeast Asian descent)
h) White (e.g., European descent)
i) Do not know
j) Prefer not to answer

What is your best estimate of your total annual personal income (before taxes and deductions)?

a.	Less than $15,000
b.	$15,000 to $20,000
c.	$20,000 to $25,000
d.	$25,000 to $30,000
e.	$30,000 to $40,000
f.	$40,000 to $50,000
g.	$50,000 to $60,000
h.	$60,000 to $70,000
i.	$70,000 to $80,000
j.	$80,000 to $90,000
k.	$90,000 to $100,000
l.	$100,000 and over
m.	Prefer not to answer

What is your highest level of school you have completed?

a.	No schooling
b.	Some secondary/high school (unfinished)
c.	Completed secondary/high school

d. Some CEGEP, community college, or technical college (unfinished)
e. Completed CEGEP, community college, or technical college
f. Some university (unfinished)
g. Bachelor's degree
h. Master's degree
i. Doctorate degree
j. Prefer not to answer

What is your current employment status?
a. Employed: Full Time
b. Employed: Part-Time
c. Seeking Employment
d. Retired
e. Student
f. Other, specify if desired
g. Prefer not to say

What term do you most associate with the area where you live?
a. Urban
b. Suburban
c. Rural
d. Other, specify if desired
e. Prefer not to answer

Do you live within a 20-minute drive of an industrial park or business park?
a. Yes
b. No
c. I don't know
d. Prefer not to answer

Do you live within a 20-minute drive of energy infrastructure (e.g., wind turbines, oil refineries, a nuclear facility, an electrical substation).
a. Yes
b. No
c. I don't know
d. Prefer not to answer

Do you live within a 10-minute drive of a major highway?
a. Yes
b. No
c. I don't know
d. Prefer not to answer

What are the first three digits of your postal code?

a. Enter here
b. Prefer not to answer

PART 2: CLIMATE CHANGE BASICS

Global warming has been receiving a lot of attention in the news recently. Global warming refers to the notion that average temperatures have been increasing globally for the past 150 years, and that this trend will continue into the future.

Do you think that global warming is occurring?
a. Yes
b. No
c. I don't know
d. Prefer not to answer

Assuming that global warming is happening, do you think that:
a. Global warming is primarily caused by human activities
b. Global warming is primarily caused by changes within nature and the environment
c. That global warming is not happening
d. Other, specify if desired
e. I don't know
f. Prefer not to answer

Please indicate how strongly you agree or disagree with the below statements:

"Global warming is affecting the Canadian economy"
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

"Global warming will harm people in Canada"
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

"Global warming will harm people in my geographic community"
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree

d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“Global warming will harm me and/or my family members”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“Global warming is already harming Canadians”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“I have already experienced the effects of global warming”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

PART 3: PERCEPTIONS OF GOVERNMENT RESPONSIVENESS

Internationally, nationally, and locally, governments are currently working on plans to limit the impacts of global warming on individuals and communities. The following section will ask you to consider the current role of Canada's federal government, your provincial government, and your local government (e.g., municipal, regional, or otherwise) in combating global warming.

Please indicate how strongly you agree or disagree with the below statements:

*“*All levels of government should act and implement laws and programs that take the environment into consideration.”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“I feel well informed about what actions the federal government is taking to combat global warming.”

g. Strongly agree
g. Somewhat agree
g. Neither agree nor disagree
g. Somewhat disagree
g. Strongly disagree
g. Prefer not to answer

“I feel well informed about what actions the provincial government is taking to combat global warming.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“I feel well informed about what actions my local government is taking to combat global warming”.

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“When the federal government says it will do something (e.g., pass laws, invest in my community, etc.), I am confident they will follow through.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“When the provincial government says it will do something (e.g., pass laws, invest in my community, etc.), I am confident they will follow through.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“When my local government says it will do something (e.g., pass by-laws, invest in the community, etc.), I am confident they will follow through.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The federal government is doing all that it can to combat global warming.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The provincial government is doing all that it can to combat global warming.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“My local government is doing all that it can to combat global warming.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The federal government provides adequate financial support to my community to combat global warming.”

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The provincial government provides adequate financial support to my community to combat global warming.”

a. Strongly agree
b. Somewhat agree

c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“My local government responds appropriately to the challenges facing my community, including climate change.”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“I believe my local government has all the tools needed to address climate change”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The federal and provincial government work well together to address global warming.”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The provincial government and my local government work well together to address global warming.”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

“The federal government provides adequate support to my local government in addressing global warming.”
a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree

f. Prefer not to answer

"The provincial government provides adequate support to my local government in addressing global warming."

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

"I would like to see greater cooperation between the federal and provincial government in addressing global warming."

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

"I would like to see greater cooperation between the federal government and my local government in addressing global warming."

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

"I would like to see greater cooperation between the provincial government and my local government in addressing global warming."

a. Strongly agree
b. Somewhat agree
c. Neither agree nor disagree
d. Somewhat disagree
e. Strongly disagree
f. Prefer not to answer

PART 4: SUPPORT FOR FUTURE GOVERNMENT ACTIONS

Transportation is the second largest source of Canadian CO_2 emissions. Freight transportation on major highways and roads is the single largest source of Canada's transportation emissions. Transport Canada recently published a Nation-wide strategic plan, and many provinces and municipalities are considering their own plans to manage the transportation system, and in particular, the road-freight system. Keeping this in mind,

consider what interventions you would like to see from each level of government in answering these questions.

Identify who you believe should be responsible for each of the following interventions. Select all that apply.

The coordination of where to allow new logistics centres and industrial parks to be sited and constructed.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Organized new regional agencies to coordinate transportation projects that cross multiple jurisdictions.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Support in the development of regional and national zoning standards to simplify commercial and industrial construction.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Support for local agencies to integrate environmental data (e.g., about where wetlands are, floodplains, sensitive natural zones, etc.) with current zoning information to identify where developments should and should not be located.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Funding and support of private firms that purchase electric vehicles for the delivery of goods.

a) Federal government
b) Provincial government
c) Municipal government
d) I do not think any level of government should pursue this intervention
e) I don't know
f) Prefer not to answer

Funding and support for the development of electric vehicle charging stations on major Canadian highways.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Funding and support for research and development in the private sector for green freight vehicle technology.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Funding and support for research and development in universities for green freight vehicle technology.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Funding for the expansion of rail freight corridors across Central and Atlantic Canada.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don't know
f. Prefer not to answer

Funding for the expansion of federal, provincial, and local highways and roads across Central and Atlantic Canada.

a. Federal government
b. Provincial government
c. Municipal government
d. I do not think any level of government should pursue this intervention
e. I don’t know
f. Prefer not to answer

General Population Survey (French)

Enquête auprès de la population Générale

Le Canada s'est engagé à atteindre les objectifs climatiques internationaux dans le cadre de l'Accord de Paris. Chaque province et de nombreuses municipalités se sont également engagées à atteindre des objectifs climatiques supplémentaires pour atténuer le réchauffement climatique. L'objectif de cette enquête est de recueillir des informations et de comprendre la perception des Canadiens sur la façon dont leurs gouvernements réagissent au réchauffement climatique et au développement de nouvelles infrastructures, et en particulier d'infrastructures de transport, pour soutenir cette réaction.
Cette enquête est ouverte aux résidents de l'Ontario, du Québec, du Nouveau-Brunswick et de la Nouvelle-Écosse.

Afin de faciliter la lecture du présent texte, nous avons employé le masculin pour désigner toutes personnes.

SECTION 1 : QUESTIONS SOCIODÉMOGRAPHIQUES

Dans quelle province résidez-vous actuellement ?

a. Ontario
b. Québec
c. Nouveau-Brunswick
d. Nouvelle-Écosse
e. Je réside dans une autre province ou à l'étranger.

Si e) est sélectionné, rediriger le participant vers un écran le remerciant pour son temps et lui indiquant qu'il n'est pas éligible pour répondre à cette enquête.

Travaillez-vous pour le gouvernement fédéral, le gouvernement provincial, une agence gouvernementale régionale ou le gouvernement municipal ?

a. Oui
b. Non

Si la réponse est oui, rediriger le participant vers un écran le remerciant pour son temps et lui indiquant qu'il n'est pas éligible pour répondre à cette enquête.

Quel âge avez-vous ?

a.	18 - 24
b.	25 - 30
c.	31 - 35
d.	36 - 40
e.	40 - 45
f.	50 - 55
g.	60 - 65
h.	70 - 75
i.	75 ans ou plus
j.	Préfère ne pas répondre

À quel sexe vous identifiez-vous ? Veuillez sélectionner toutes les réponses qui s'appliquent.

a.	Homme
b.	Femme
c.	Transgenre
d.	Non-binaire
e.	Précisez, si vous le souhaitez
f.	Préfère ne pas répondre

Quelle langue parlez-vous le plus souvent à la maison ?

a.	Français
b.	Anglais
c.	Autre, précisez si vous le souhaitez
d.	Préfère ne pas répondre

Comment décririez-vous vos origines ethniques ? Veuillez sélectionner toutes les réponses qui s'appliquent.

a.	Noirs (par exemple, Africains, Afro-Canadiens, descendants d'Afro-Caraïbes)
b.	Asiatiques de l'Est (par exemple, Chinois, Japonais, Coréens, Taïwanais)
c.	Indigènes (par exemple, Premières nations, Inuk/Inuit, descendants de Métis)
d.	Latino-Américain (par exemple, hispanique ou d'origine latino-américaine)
e.	Origine moyen-orientale (arabe, persane, asiatique occidentale, afghane, égyptienne, iranienne, kurde, libanaise, turque, etc.)
f.	Asiatiques du Sud (par exemple, Bangladais, Indiens, Indo-Caraïbes, Pakistanais, Sri Lankais)
g.	Asiatique du Sud-Est (Cambodgien, Philippin, Indonésien, Thaïlandais, Vietnamien ou autre descendant de l'Asie du Sud-Est)
h.	Blancs (par exemple, descendants d'Européens)
i.	Ne sait pas

j. Préfère ne pas répondre

Quelle est votre meilleure estimation de votre revenu personnel annuel total (avant impôts et déductions) ?

a. Moins de 15 000 $
b. 15 000 $ à 20 000 $
c. 20 000 $ à 25 000 $
d. 25 000 $ à 30 000 $
e. 30 000 $ à 40 000 $
f. 40 000 $ à 50 000 $
g. 50 000 $ à 60 000 $
h. 60 000 $ à 70 000 $
i. 70 000 $ à 80 000 $
j. 80 000 $ à 90 000 $
k. 90 000 $ à 100 000 $
l. 100 000 $ et plus
m. Préfère ne pas répondre

Quel est le niveau de scolarité le plus élevé que vous ayez atteint ?

a. Pas de scolarisation
b. Études secondaires (non terminées)
c. Diplôme d'études secondaires
d. Un CEGEP, un collège communautaire ou un collège technique (non terminé)
e. Diplômé d'un CEGEP, d'un collège communautaire ou d'un collège technique
f. Une université (inachevée)
g. Baccalauréat
h. Maîtrise
i. Doctorat
j. Préfère ne pas répondre

Quelle est votre situation professionnelle actuelle ?

a. Employé : Temps plein
b. Employé : Temps partiel
c. Recherche d'emploi
d. Retraité
e. Étudiant
f. Autre, précisez si vous le souhaitez
g. Préfère ne pas se prononcer

Quel terme associez-vous le plus à la région où vous vivez ?

a. Urbaine
b. Banlieue
c. Rurale
d. Autre, précisez si vous le souhaitez

e. Préfère ne pas répondre

Habitez-vous à moins de 20 minutes en voiture d'un parc industriel ou d'une zone d'activité ?
a. Oui
b. Non
c. Je ne sais pas
d. Préfère ne pas répondre

Habitez-vous à moins de 20 minutes en voiture d'une infrastructure énergétique (par exemple, des éoliennes, des raffineries de pétrole, une installation nucléaire, une sous-station électrique) ?
a. Oui
b. Non
c. Je ne sais pas
d. Préfère ne pas répondre

Habitez-vous à moins de 10 minutes en voiture d'un grand axe routier ?
a. Oui
b. Non
c. Je ne sais pas
d. Préfère ne pas répondre

Quels sont les trois premiers chiffres de votre code postal ?
a. Entrer ici
b. Préfère ne pas répondre

SECTION 2 : LES BASES DU CHANGEMENT CLIMATIQUE

Le réchauffement climatique a récemment fait l'objet d'une grande attention dans les médias. Le réchauffement climatique fait référence à l'idée que les températures moyennes ont augmenté au niveau mondial au cours des 150 dernières années et que cette tendance se poursuivra à l'avenir.

Pensez-vous que le réchauffement climatique est en train de se produire ?
a. Oui
b. Non
c. Je ne sais pas
d. Préfère ne pas répondre

En supposant que le réchauffement climatique se produise, pensez-vous que :
a. Le réchauffement climatique est principalement causé par les activités humaines
b. Le réchauffement climatique est principalement causé par des changements dans la nature et l'environnement
c. Le réchauffement climatique n'est pas en train de se produire

d. Autre, précisez si vous le souhaitez
e. Je ne sais pas
f. Préfère ne pas répondre

Veuillez indiquer dans quelle mesure vous êtes d'accord ou non avec les affirmations ci-dessous :

"Le réchauffement climatique affecte l'économie canadienne".
a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le réchauffement climatique va nuire aux habitants du Canada".
a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le réchauffement climatique va nuire aux habitants de ma communauté géographique".
a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le réchauffement climatique va me nuire et/ou nuire aux membres de ma famille".
a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le réchauffement climatique nuit déjà aux Canadiens".
a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"J'ai déjà ressenti les effets du réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

SECTION 3 : PERCEPTIONS DE LA RESPONSABILITÉ DU GOUVERNEMENT

Au niveau international, national et local, les gouvernements travaillent actuellement sur des plans visant à limiter les impacts du réchauffement climatique sur les individus et les communautés. La section suivante vous demandera de réfléchir au rôle actuel du gouvernement fédéral du Canada, de votre gouvernement provincial et de votre gouvernement local (municipal, régional ou autre) dans la lutte contre le réchauffement de la planète.

Veuillez indiquer dans quelle mesure vous êtes d'accord ou non avec les affirmations ci-dessous :

"Tous les niveaux de gouvernement devraient agir et mettre en œuvre des lois et des programmes qui tiennent compte de l'environnement".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Je me sens bien informé sur les mesures prises par le gouvernement fédéral pour lutter contre le réchauffement climatique".

g. Tout à fait d'accord
g. Plutôt d'accord
g. Ni d'accord ni en désaccord
g. Plutôt en désaccord
g. Pas du tout d'accord
g. Préfère ne pas répondre

"Je me sens bien informé sur les mesures prises par le gouvernement provincial pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Je me sens bien informé sur les mesures prises par mon gouvernement local pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Lorsque le gouvernement fédéral dit qu'il va faire quelque chose (par exemple, adopter des lois, investir dans ma communauté, etc.), j'ai confiance dans le fait qu'il va le faire".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Lorsque le gouvernement provincial dit qu'il fera quelque chose (par exemple, adopter des lois, investir dans ma communauté, etc.), j'ai confiance qu'il le fera".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Lorsque mon gouvernement local dit qu'il va faire quelque chose (par exemple, adopter des règlements, investir dans la communauté, etc.), j'ai confiance dans le fait qu'il va le faire".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le gouvernement fédéral fait tout ce qui est en son pouvoir pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le gouvernement provincial fait tout ce qui est en son pouvoir pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Mon gouvernement local fait tout ce qui est en son pouvoir lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le gouvernement fédéral apporte un soutien financier adéquat à ma communauté pour lutter contre le réchauffement climatique."

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le gouvernement provincial apporte un soutien financier adéquat à ma communauté pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Mon gouvernement local répond de manière appropriée aux défis auxquels ma communauté est confrontée, y compris le changement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Je pense que mon gouvernement local dispose de tous les outils nécessaires pour lutter contre le changement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Les gouvernements fédéral et provincial travaillent en bonne intelligence pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

Le gouvernement provincial et mon administration locale travaillent bien ensemble pour lutter contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le gouvernement fédéral apporte un soutien adéquat à mon administration locale dans la lutte contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"Le gouvernement provincial apporte un soutien adéquat à mon administration locale dans la lutte contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"J'aimerais voir une plus grande coopération entre les gouvernements fédéral et provinciaux dans la lutte contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"J'aimerais voir une plus grande coopération entre le gouvernement fédéral et mon gouvernement local dans la lutte contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

"J'aimerais voir une plus grande coopération entre le gouvernement provincial et mon gouvernement local dans la lutte contre le réchauffement climatique".

a. Tout à fait d'accord
b. Plutôt d'accord
c. Ni d'accord ni en désaccord
d. Plutôt en désaccord
e. Pas du tout d'accord
f. Préfère ne pas répondre

SECTION 4 : SOUTIEN AUX FUTURES ACTIONS GOUVERNEMENTALES

Le transport est la deuxième source d'émissions de CO_2 au Canada. Le transport de marchandises sur les autoroutes et les routes principales est la plus grande source d'émissions du secteur des transports au Canada. Transports Canada a récemment publié un plan stratégique national, et de nombreuses provinces et municipalités envisagent d'élaborer leurs propres plans de gestion du système de transport, et en particulier du système de transport routier de marchandises. En gardant cela à l'esprit, réfléchissez aux interventions que vous souhaiteriez voir de la part de chaque niveau de gouvernement pour répondre à ces questions.

Identifiez la personne qui, selon vous, devrait être responsable de chacune des interventions suivantes. Sélectionnez toutes les réponses qui s'appliquent.

La coordination de l'implantation et de la construction de nouveaux centres logistiques et parcs industriels.

a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention

e. Je ne sais pas
f. Préfère ne pas répondre

Organisation de nouvelles agences régionales pour coordonner les projets de transport qui relèvent de plusieurs juridictions.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Soutien à l'élaboration de normes de zonage régionales et nationales pour simplifier la construction commerciale et industrielle.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Soutien aux agences locales pour qu'elles intègrent les données environnementales (par exemple, sur la localisation des zones humides, des zones inondables, des zones naturelles sensibles, etc.) aux informations de zonage actuelles afin d'identifier les endroits où les développements devraient ou ne devraient pas être situés.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Financement et soutien des entreprises privées qui achètent des véhicules électriques pour la livraison de marchandises.
g. Gouvernement fédéral
g. Gouvernement provincial
g. Administration municipale
g. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
g. Je ne sais pas
g. Préfère ne pas répondre

Financement et soutien pour le développement de stations de recharge de véhicules électriques sur les principales routes canadiennes.

a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Financement et soutien de la recherche et du développement dans le secteur privé pour la technologie des véhicules de transport de marchandises écologiques.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Financement et soutien de la recherche et du développement dans les universités pour la technologie des véhicules de transport de marchandises écologiques.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Financement de l'expansion des corridors de fret ferroviaire à travers le Canada central et atlantique.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répondre

Financement de l'expansion des autoroutes et des routes fédérales, provinciales et locales dans le centre et les provinces de l'Atlantique.
a. Gouvernement fédéral
b. Gouvernement provincial
c. Administration municipale
d. Je pense qu'aucun niveau de gouvernement devrait poursuivre cette intervention
e. Je ne sais pas
f. Préfère ne pas répond

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