

Toward a Holistic Understanding of
Motivations, Barriers, and Enablers to
Net-Zero Cities:

A Comprehensive and Transdisciplinary
Inquiry in Japan

MYASOEDOV FEDOR

Doctor of Philosophy

**Toward a Holistic Understanding of
Motivations, Barriers, and Enablers to
Net-Zero Cities:**

**A Comprehensive and Transdisciplinary
Inquiry in Japan**

（ネットゼロ都市に向けた動機・障
壁・促進要因の総合的理解に向けて
—日本における包括的かつトランスディシプリナリー
な研究—）

MYASOEDOV FEDOR

Graduate School of Advanced Integrated Studies
in Human Survivability, Kyoto University

March 2026

Abstract

Cities' climate policies and actions are essential for mitigating and adapting to global warming. However, progress toward achieving net-zero emissions in cities remains insufficient and uneven. Cities often lack the motivation and political will to pursue climate objectives, while also being constrained by limited capacities (i.e., municipal resources and knowledge) or institutional inefficiencies (e.g., lack of coordination and cooperation among public and private actors).

Through a comprehensive and transdisciplinary inquiry, this dissertation seeks to advance a more holistic understanding of the question: Why municipalities pursue net-zero goals, and what obstructs or facilitates their progress? The study focuses on Japan, where more than 95 percent of the population resides in municipalities that have pledged to achieve net-zero CO₂ emissions by 2050. The research combines literature-based conceptual synthesis, a nationwide survey that yielded both quantitative and qualitative data, mixed-methods analysis, and transdisciplinary engagement with societal actors. The overarching aim is to illuminate the Motivations, Barriers, and Enablers (MBEs) that shape municipal progress toward net zero.

Following the Introduction chapter which establishes the background and context of the study, the dissertation unfolds as follows:

Chapter 2 – Analytical Framework

The study begins by building an analytical foundation. This chapter synthesizes and organizes the existing scattered body of scholarship on municipal motivations, barriers, and enablers (MBEs) of climate action. Drawing from a wide range of literature, it extracts and consolidates overlapping and recurrent factors into three corresponding lists: (1) motivations, (2) barriers and (3) enablers. Further, based on hints from the literature, the chapter develops an Integrated Analytical Framework: a conceptual depiction that brings the three domains together within a single schematic illustrating their potential interconnections at a broad, theoretical level. This framework serves both as a theoretical grounding for the empirical work that follows and as a reference point for later analysis and synthesis.

Chapter 3 – Research Design and Survey Implementation.

Building on the analytical framework, Chapter 3 introduces the methodological design of the empirical study. It describes the overall mixed-method survey structure, sampling frame, and implementation process, outlining how quantitative and qualitative data were collected concurrently by targeting a sample of Japan's 489 municipalities that have declared Zero Carbon City commitments. The survey structure was carefully designed to capture both quantitative and qualitative dimensions of practitioner experience—beginning with factor evaluations, proceeding

through single-item prioritization, and concluding with open-ended reflections. This mixed-format instrument enabled a balance between breadth and depth, engagement and precision, ultimately yielding one of the most extensive datasets on the topic to date.

Chapter 4 – Quantitative Results and Analysis.

The fourth chapter presents the results of the quantitative analyses of survey data. It identifies which MBE factors municipal officials perceive as most significant, revealing dominant motivations, persisting barriers, and promising enabling conditions. Correlation analysis further uncovers associations among factors, hinting at the interrelationships that may underlie the dynamics of local climate governance. The chapter situates and discusses these findings within the literature before concluding with a bird's-eye view of the highest-ranked MBEs, embedding them within the conceptual structure of the Integrated Analytical Framework developed earlier in Chapter 2.

Chapter 5 – Thematic Analysis of Qualitative Responses.

Deepening the understanding, Chapter 5 turns to the open-ended survey responses. It examines nearly one thousand textual responses from municipal officials, applying thematic analysis to uncover how practitioners rationalize and contextualize their most significant MBEs. This approach bridges the interpretive richness of qualitative inquiry with the representativeness of large-sample survey research. In doing so, it explores the collective interpretive logic behind municipalities' assessments, uncovering the common reasoning, framings, and local narratives that explain why certain factors hold importance and how they manifest in practice. Furthermore, open-ended responses illuminate potential causal relationships among factors as expressed by respondents themselves.

Chapter 6 – Transdisciplinary Engagement and Societal Interaction.

This chapter extends beyond the purely academic realm to encompass society and practice through experimentation with the elements of transdisciplinary inquiry. It describes a series of activities that engaged with the societal realm: continuous communication with practitioners through a long-term immersive internship (*Musha-shugyō*), facilitation of dialogues through organization of an international multi-stakeholder forum (Project-Based Research), as well as public outreach and educational initiatives. These activities allowed feedback, mutual learning, and the co-production of knowledge, thus bridging scientific analysis with real-world experiences. Reflecting on these experiences, this chapter also includes a self-reflexive contemplation on how the transdisciplinary theory can be operationalized in graduate research settings and proposes a framework that brings together various conceptual and practical approaches to transdisciplinarity – both in the East and in the West.

Chapter 7 – Final Synthesis: The Integrated Heuristic of Local Climate Governance.

The final chapter begins by comparing the outcomes of the empirical survey with a few existing analogous survey-based explorations of related topics. It further notes that the current literature lacks an integrated, system-level understanding of the dynamic interplay among factors. Hence, the dissertation culminates in integrating all strands of evidence—existing knowledge, quantitative and qualitative findings, and transdisciplinary insights—into a holistic framework that illuminates this interplay. The resulting Integrated Heuristic Model of Local Climate Governance (IHM) is a conceptual model, derived inductively from empirical evidence, that unites motivations, barriers, and enablers within a single structure and illuminates their interactions. The heuristic offers both a theoretical contribution—a systemic view of MBEs of local climate governance—and a practical tool for diagnosing challenges and identifying strategic pathways and leverage points for action. The chapter concludes the dissertation by summarizing its practical and theoretical contributions, acknowledging limitations, and outlining avenues for future research.

In sum, these chapters advance a coherent investigation that moves from mapping existing knowledge to empirically examining municipal perspectives and, finally, to integrating these insights into a unifying conceptual structure. The dissertation clarifies the landscape of Motivations, Barriers, and Enablers, generates large-scale evidence on how municipalities evaluate and prioritize them, and enriches these findings with the interpretive depth of qualitative thematic analysis. Furthermore, the study incorporates elements of a transdisciplinary approach, striving to co-produce knowledge together with societal actors rather than remaining siloed within academia.

Overall, the dissertation contributes new conceptual clarity, large-scale empirical evidence, interpretive insight, and practice-oriented guidance. While focused on Japan, its findings and heuristic model offer broader relevance for municipalities seeking to strengthen their capacity, coordination, and commitment in the pursuit of net-zero transitions.

Statement of Authored Publications

The following publications were authored by the candidate prior to and during the preparation of this dissertation:

I. Academic peer-reviewed journal articles

1. Myasoedov, F., & Ialnazov, D. S. (2025). Key Motivations, Barriers, and Enablers Toward Net-Zero Cities: An Integrated Framework and Large Survey in Japan. *Climate*, 13(7), 134. <https://doi.org/10.3390/cli13070134>

This paper introduces the integrated analytical framework, describes the survey design, and presents the findings from the quantitative analysis of the empirical data. It further discusses the results in relation to the literature on urban climate governance and outlines policy implications.

This publication is substantial in scope and corresponds to Chapters 2, 3, and 4 of this dissertation.

The paper is published as open access under the Creative Commons Attribution (CC BY) license, with full copyright retained by the authors.

2. Myasoedov, F. What Drives Municipal Climate Action: Intrinsic Motivations and Agency Behind Japan's Zero-Carbon Cities. *Cities*. (*under review*)

This paper focuses specifically on the motivations of Japanese municipalities in pursuing net-zero city objectives. It presents findings from the thematic analysis of qualitative data collected through the survey.

As the paper deliberately excludes barriers and enablers from its analytical scope, it corresponds to selected parts of Chapters 5 and 7 that address motivations only.

The manuscript was written in parallel with this dissertation, and its status was *under review* at the time of dissertation submission and defense. The journal's copyright policy does not restrict authors from reusing their own work in a doctoral thesis.

II. Institutional peer-reviewed papers

3. Myasoedov, F., & Ota, J. (2021). Pathway to a Zero Carbon City: Island of Energy, Goto City, Japan. *Institute for Global Environmental Strategies*. <https://doi.org/10.57405/iges-11816>

The candidate was the lead author of this publication, which was prepared and published during his 2021 internship at the Institute for Global Environmental Strategies (IGES) at an early stage of his doctoral research.

This dissertation does not reproduce verbatim content from the publication, nor does it contain a dedicated chapter corresponding directly to it. Instead, insights from the article are selectively referenced throughout the dissertation where relevant, with appropriate citation.

All publications listed above are original works of the candidate, and any reuse within this dissertation complies with the relevant publisher and institutional policies

Acknowledgements

Although a dissertation bears a single name on its cover, this one is truly the result of the support, guidance, and kindness of many people. I am deeply grateful to everyone who has accompanied me on this journey.

First and foremost, I am profoundly grateful to my supervisor, Professor Dimiter Ialnazov. From our very first meeting, he encouraged me to pursue my own research curiosity and trusted me to find my path. He showed patience during periods of slow progress, read my work with remarkable care, and even joined me in fieldwork. I am sincerely thankful not only for his thoughtful academic guidance but also for his consistent kindness and support throughout these years.

I would also like to acknowledge my former supervisor, Professor Shigeki Sakurai, for his patience and understanding during the early stages of my doctoral study, when my research ideas were still taking shape. I am grateful to my second supervisor, Professor Takashi Sekiyama, for his mentorship and for the thoughtful comments he provided during his seminars, which helped refine my work. My sincere thanks also go to Professor Yousuke Yamashiki for serving on my examination committee and for his careful reading of the thesis and valuable feedback. I am likewise grateful to other faculty members at GSAIS for their teaching and academic support throughout my studies, as well as to professors outside GSAIS—Gregory Trencher, Shunsuke Managi, Takashi Nakazawa, and Andrew Chapman—who supported me at various stages of my research.

A particularly formative experience during my PhD was my Musha-shugyō internship at IGES. I owe special thanks to Junko Ota, whose mentorship extended far beyond the internship itself. She supported me in arranging interviews in Kitakyushu, accompanied me during fieldwork in Kyushu, participated as a speaker in my PBR Forum, facilitated the SDG game at GSAIS, and continued to encourage me throughout my doctoral journey. I am also thankful to all colleagues at the IGES Kitakyushu Urban Centre for their warm collaboration and support.

My sincere thanks go to the participants of my PBR Forum: Yasuko Kameyama (University of Tokyo); Shoichiro Kikuta (Kyoto City Hall); Michito Aoi (Kobe Port Bureau); Togo Uchida (ICLEI Japan); Fritz Akhmad Nuzir (Bandar Lampung University); and Alessandra Gosch (Federal University of Paraná). Their participation and insights strengthened both the empirical depth and practical relevance of this dissertation.

I am deeply grateful to Masahiko Ota and Yoshimasa Ito, who kindly arranged interviews in Kitakyushu during my early fieldwork, accompanied me throughout the process, and patiently interpreted when my Japanese was far from fluent. In the subsequent survey stage, I am especially grateful to Shimon Nakanishi, a linguist and fellow doctoral student at Kyoto University, for his expert support in translating the survey and crafting precise, culturally appropriate communication

with municipalities, which proved crucial to its successful implementation. His support—both professional and personal—made a real difference, and I deeply value his friendship.

I am sincerely thankful to all municipal officials across Japan who responded to my survey. Their time, openness, and thoughtful reflections form the very foundation of this research; without their engagement, this dissertation would not exist.

I was fortunate to receive financial support during parts of my doctoral studies through scholarships that I was honored to earn. I gratefully acknowledge the Tokyu Scholarship Foundation and the JST SPRING program (Grant Number JPMJSP2110). The former supported me financially for two years and created opportunities to build lasting friendships with fellow international students through its networking gatherings. The latter was instrumental during the crucial final stages of my doctoral journey. These scholarships were invaluable at key moments and made it possible for me to continue and complete this work.

To my fellow students and colleagues—labmates and classmates, seniors and juniors, at and outside GSAIS—many of whom became close friends (in no particular order): Ayaka Watanabe, Keiji Sakakibara, Hirata Reo, Ryotaro Kusumoto, Shoko Iwasaki, Daikichi Seki, Thiago Chuba, Li Wenlong, Francisco Medina, Kouta Futsuki, Ryo Tsuchida, Marcelo Kakihara, Shasha Li, Ismail Sadaf, Shun Kuriki, Hang Zhewen, Ni Xuwen, Ke Deng, Jin Zhe, Go Kazawa, Eri Tsuruha, Hiroaki Sato, Takato Nagano, Alex Keeley, Shutaro Takeda, Charles Boliko, Chen Shiqi, Mariko Fukui, Krinah Jani, Nyaruai Theuri, Tatsuro Mukai, Daisuke Sato, Asato Taiki, Nobumichi Shinohara, Toshiki Muraoka, Kazuho Nomura, Wen Min, Yugo Tanaka, Haruna Omura, Lobsang Gnon Na, Srijon Barua, Rimsa Goperma, Rojan Basnet, Thierry Coulibaly, and others I may unintentionally omit—I am deeply grateful. Your support and companionship made pursuing a doctoral degree in “Human Survivability” genuinely survivable.

A special shoutout to Ayame Ishida, Rachael Kawasaki, and Zelda Marquardt—our small circle, aka “the dolphins”—with whom I shared many ups and downs at GSAIS and created unforgettable memories. I also owe particular gratitude to my friend Luke Macon, who has been navigating the PhD journey alongside me and with whom the length of our exchanges—about research, philosophy of science, academic life, and beyond—easily exceeded the length of this dissertation. These friendships sustained me emotionally and mentally during the hardest times and will be cherished well beyond my time at GSAIS.

Finally, my deepest gratitude goes to my family and friends in Russia. Even from afar, their steady love, support, and belief in me carried me through every stage of this journey.

If this dissertation forms a coherent whole, it is because so many individuals contributed their time, ideas, and encouragement. For that collective effort, I am deeply thankful.

Contents

Abstract.....	i
Statement of Authored Publications.....	iv
Acknowledgements.....	v
Contents.....	vii
List of Figures.....	x
List of Tables.....	xii
List of Abbreviations.....	xiii
Chapter 1. Introduction and Background	1
1.1 Background and Context	1
1.1.1 Cities, Local Governments, and Urban Policymakers Responding to Climate Change	1
1.1.2 The Local Net Zero Commitments Trend and the Case of Japan.....	3
1.2 Problem: Inadequate Local Climate Governance and Its Understanding.....	6
1.2.1 Despite Rhetoric, Action Remains Insufficient – What Drives or Impedes Local Action?.....	6
1.2.2 Motivations, Barriers, and Enablers to Net-Zero Cities: Research Gaps and Questions	8
1.3 Addressing the Gaps through a Multi-Faceted Integrative Research	15
1.3.1 Overview of Research Questions:.....	15
1.3.2 Research Objectives and Logic of the Inquiry.....	15
1.4 Structure of the Dissertation	17
Chapter 2. An Integrated Analytical Framework.....	20
2.1 Building the Analytical Framework Through Extensive Literature Review.....	20
2.2 Motivations: Conceptual Foundations and Literature Synthesis	21
2.3 Barriers and Enablers: Conceptual Foundations and Synthesis	25
2.4 Conceptual Interrelations and Integrated Depiction of MBEs	31
Chapter 3. Survey Design and Implementation	33
3.1 Conceptual Basis and Survey Structure	33
3.2 Target Population and Sampling Frame	34
3.3 Questionnaire Validation, Endorsement, Positioning, and Ethics.....	36
3.4 Contact Strategy and Data Collection Protocol.....	37
3.5 Response Profile and Data Quality Considerations.....	37
Chapter 4. Key Motivations, Barriers, and Enablers toward Net-Zero Cities.....	40
4.1 Introduction	40
4.2 Descriptive Statistical Analysis of the Quantitative Survey Response	41
4.2.1 Survey Results: Motivations	41

4.2.2 Survey Results: Barriers	43
4.2.3 Survey Results: Enablers	50
4.2.4 Correlation Analysis	55
4.3 Discussion and Implications	58
4.3.1 Major Motivations	58
4.3.2 Major Barriers and Enablers	62
4.3.3 Applicability Beyond Japan	69
4.4 Conclusions	70
Chapter 5. Toward Deeper Understanding: A Thematic Analysis of the Qualitative Responses	73
5.1 Introduction	73
5.2 Methodology	76
5.2.1 Yielding a Substantial Qualitative Dataset through a Stepwise Survey Design	76
5.2.2 Qualitative Analysis Process	79
5.3 Results	85
5.4 Discussion	108
5.4.1 Dominance of Economic Motivations among the Top Ranks Explained	108
5.4.2 Insights into Non-Economic Climate Action Motivation	112
5.4.3 Themes Explaining Barriers and Enablers of Local Climate Action	118
5.5 Conclusion	132
Chapter 6. Bridging Academic and Societal Knowledge Creation: Transdisciplinary Activities	135
6.1 Introduction	135
6.2 Theoretical Framing of Transdisciplinary Inquiry	136
6.3 Participatory/Catalytic Research Activities as Part of Doctoral Study	140
6.3.1 Internship: Exploring Conducive Background Factors to Net-Zero Cities through Fieldwork in Kyushu	143
6.3.2 Project-Based Research: International Forum on Zero-Carbon Cities	149
6.3.3 Other Action-Oriented Contributions	152
6.3.4 Summary of Participatory/Catalytic Research Activities	153
6.4 Self-reflexive Discussion in Relation to the GSAIS Curriculum and a Framework Operationalizing Transdisciplinary Theory	154
6.4.1 Trans-Science as a Parallel Route to Transdisciplinarity	155
6.4.2 GSAIS: A Pedagogical Experiment in Trans-Science and Transdisciplinarity	156
6.4.3 A Framework for Operationalizing Transdisciplinary Learning	157
6.5 Conclusion	160
Chapter 7. Final Reflections, Holistic Model Synthesis, and Concluding Remarks	162
7.1 Introduction	162
7.1.1 Discussion of the Study Outcomes in Relation to Existing Literature	163
7.1.2 The Need for an Integrated and Systemic Understanding of Barriers, Enablers, and Motivations	169

7.2 Methodology: Making of an Integrated Heuristic Model of Local Climate	
Governance	171
7.2.1 Synthesizing Motivations	172
7.2.2 Plotting a bird's-eye view of Barriers, Enablers, and their Interrelations	174
7.2.3 Recognizing the Multi-Actor and Multi-Level Pattern.....	176
7.2.4 From Complexity to Coherence.....	177
7.2.5 The Role of the Heuristic.....	178
7.3 Results and Discussion: Presenting the Integrated Heuristic Model	178
7.3.1 Describing the Barriers Heuristic	178
7.3.2 Towards Overcoming Barriers: Introducing the Enablers Heuristic and its Usage	186
7.3.3 Completing the Picture: The Role of Motivations.....	196
7.3.4 Model Limitations and Applicability.....	203
7.4 Dissertation's Concluding Reflections	204
7.4.1 Revisiting the Research Problem	204
7.4.2 Summary of Approach and Key Contributions	205
7.4.3 Practical and Theoretical Implications	207
7.4.4 Transferability of the Findings Beyond the Japanese Context	209
7.4.5 Overall Limitations	210
7.4.6 Concluding Takeaways.....	211
References	213
Appendix A. Survey Questionnaire (in Japanese).....	A-1
Appendix B. List of Respondents.....	B-1
Appendix C. Correlation Analysis on the Survey Responses.....	C-1
Appendix D. Working Paper.....	D-1

List of Figures

Figure 2.1. Conceptual depiction of the integrated analytical framework of motivations, barriers, and enablers (MBEs) toward net-zero emission cities.....	32
Figure 3.1. Survey sample of 489 Zero Carbon Cities—Japanese municipalities committed to net-zero emissions (as of January 2022).....	35
Figure 4.1. Motivations toward achieving net-zero emissions by municipalities.....	41
Figure 4.2. Barriers to achieving net-zero emissions by municipalities (Category I: Municipal capacity constraints—resources and authority).....	44
Figure 4.3. Barriers to achieving net-zero emissions by municipalities (Category II: Municipal capacity constraints—knowledge and expertise).....	45
Figure 4.4. Barriers to achieving net-zero emissions by municipalities (Category III: Institutional coherence and coordination issues).....	47
Figure 4.5. Barriers to achieving net-zero emissions by municipalities (Category IV: Insufficient leadership and political will).....	49
Figure 4.6. Enablers facilitating achieving net-zero emissions by municipalities (Category I: Adequate municipal capacity—resources and authority).....	50
Figure 4.7. Enablers facilitating achieving net-zero emissions by municipalities (Category II: Adequate municipal capacity—knowledge and expertise).....	52
Figure 4.8. Enablers facilitating achieving net-zero emissions by municipalities (Category III: Institutional coherence and coordination).....	53
Figure 4.9. Enablers facilitating achieving net-zero emissions by municipalities (Category IV: Strong political will and leadership).....	55
Figure 4.10. Municipalities’ salient motivations, barriers, and enablers—summary of responses from 309 Zero Carbon Cities in Japan.....	70
Figure 5.1. A fragment of the coding process.....	80
Figure 5.2. A fragment of the resulting structure of the open-codes.....	81
Figure 5.3. A fragment displaying the process of axial coding and synthesis of themes.....	83
Figure 6.1. An overview of participatory activities towards transdisciplinarity, their outputs, and the roles adopted.....	142
Figure 6.2. Conceptual representation of the PBR forum.....	151
Figure 6.3. An integrative conceptual map operationalizing transdisciplinary learning (based on the author’s experience and self-reflexive contemplation).....	158
Figure 7.1. Concept map of the motivation meta-themes creation.....	173
Figure 7.2. A process of plotting barrier themes—bird’s-eye schematic for later synthesis.....	175

Figure 7.3. Organization of barrier themes and their interrelations within the 3×3 multi-player and multi-scale model structure.....	176
Figure 7.4. A conceptual representation of major local climate governance barriers in an interlocking 3×3 system.....	179
Figure 7.5. A conceptual representation of major local climate governance enablers in a 3×3 system with multiple self-reinforcing loops.....	187
Figure 7.6. A schematic of potential enabling pathways towards addressing municipal resource capacity.....	189
Figure 7.7. Potential enabling pathways addressing municipal knowledge/expertise.....	192
Figure 7.8. Potential enabling pathways addressing internal (left) and external (right) coordination.....	193
Figure 7.9. Potential enabling pathways addressing awareness and priority in the city hall and community.....	195
Figure 7.10. The enabling role of motivations.....	197
Figure 7.11. The Integrated Heuristic of Local Climate Governance (complete view).....	202

List of Tables

Table 2.1. Common intrinsic motivations of municipalities toward local climate action.....	23
Table 2.2. Common barriers hindering municipal efforts toward local climate action.....	26
Table 2.3. Common enablers enhancing municipal efforts toward local climate action.....	28
Table 3.1. Survey sample characteristics and response rates by administrative category.....	38
Table 3.2. Distribution of respondents by department affiliation.....	39
Table 4.1. Prominent correlations between the salient local climate governance factors (based on survey data of Japanese municipalities working toward net-zero).....	56
Table 4.2. Correlation between the salience of barriers and enablers (based on survey data of Japanese municipalities working toward net-zero).....	57
Table 4.3. Salient local climate governance factors correlating with motivational priorities (based on survey data of Japanese municipalities working toward net-zero).....	58
Table 5.1. Qualitative response statistic.....	77
Table 5.2. Qualitative coding statistic.....	85
Table 5.3. Motivation themes (MT-1–MT-26) identified through thematic analysis of open-ended responses, with representative components and quotes.....	87
Table 5.4. Barrier themes (BT-1–BT-17) synthesized from open-ended survey responses, with representative components and quotes.....	93
Table 5.5. Enabler themes (ET-1–ET-24) synthesized from open-ended survey responses, with representative components and quotes.....	100
Table 6.1. From General Orientations to Researcher Roles: Situating the Research Activities within Transdisciplinarity Frameworks.....	139
Table 6.2. Two phases of fieldwork engagement with Kitakyushu city.....	146
Table 6.3. Fieldwork activities and insights across Kyushu municipalities.....	147
Table 6.4. Overview of participatory activities and corresponding researcher roles.....	151
Table 7.1. Comparison of Large-Scale Survey Studies on Local Climate Governance.....	166

List of Abbreviations

CDP	Carbon Disclosure Project
CED	Climate Emergency Declaration
ESCAP	UN Economic and Social Commission for Asia and the Pacific
GHG	Greenhouse Gas Emissions
HSS	Human Survivability Studies
ICLEI	International Council of Local Environmental Initiatives
IGES	Institute for Global Environmental Strategies
IHM	Integrated Heuristic Model of Local Climate Governance
IPCC	Intergovernmental Panel on Climate Change
KUC	Kitakyushu Urban Centre
MBEs	Motivations, Barriers, Enablers
MBE item(s)	An item(s) in the respective Motivation, Barrier, or Enabler section of the survey
METI	Ministry of Economy, Trade and Industry (Japan)
MOE	Ministry of Environment (Japan)
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
PBR	Project-Based Research
PPP	Public–Private Partnership
RE	Renewable Energy
SDG	Sustainable Development Goal
UCLG	United Cities and Local Governments
UNCRD	UN Centre for Regional Development
UNEP	UN Environment Programme
UNFCCC	UN Framework Convention on Climate Change
WP	Working Paper
ZEB	Zero-Energy Building

Chapter 1. Introduction and Background

“Climate change is a threat to human well-being and planetary health (*very high confidence*). There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all (*very high confidence*).”

“Limiting human-caused global warming requires net zero CO₂ emissions.”

(IPCC, 2023)

“Our struggle for global sustainability will be won or lost in cities.”

(UN Secretary-General Ban Ki-moon, 2012)

1.1 Background and Context

1.1.1 Cities, Local Governments, and Urban Policymakers Responding to Climate Change

Climate change is now widely recognized as one of the most challenging global issues threatening human survival. Although essentially global, it is also a “deeply local issue” (Romero-Lankao, 2012). Urban settlements are not only the culprits of climate change but also its major victims, and consequently, they act as key actors and sites for taking tangible action against the changing climate (Seto et al., 2021; van der Heijden, 2019).

Indeed, cities are now hosting most of the world’s population and generate more than 70 percent of global greenhouse gas emissions (IPCC, 2022b; UN-Habitat, 2022). As dense hubs of people, infrastructure, and economic activities, they are not only major emitters but also highly vulnerable to climate change impacts such as floods, heat stress, and other threats (Romero-Lankao & Dodman, 2011). Naturally, being part of the problem, they are also part of the solution (Bulkeley et al., 2009). Cities are in charge of many of the systems that shape emissions, such as transport, energy, buildings, and waste, and hence are critical to “advance social changes, such as modal shifts, infrastructure upgrades, energy efficiency and low-carbon urban forms” (UN-Habitat, 2022). As such, scholars widely describe cities as being “at the front line” and “center stage” for action on climate change (Joss, 2015); as a “natural point” for appropriate policy discussions and interventions (Lee & Koski, 2012); as “important spaces” where momentum toward low-carbon transitions can be fostered (Denton et al., 2022); and as “sources of innovations” and incubators of “synergies and resources” towards effective adaptation and mitigation strategies (Romero-Lankao & Dodman, 2011).

The importance of the local level in addressing global environmental challenges and advancing sustainable development has been consistently emphasized and embedded in major international conventions and frameworks. This recognition can be traced from the Brundtland Report

(1987) and the UN's Agenda 21 (1992) to the inclusion of the “urban goal”, i.e., the Sustainable Development Goal N11, as a standalone objective in the 2030 Agenda for Sustainable Development (2015), endorsed by a wide coalition of international actors (Fuhr et al., 2018; UN-Habitat, 2022). Indeed, the recent IPCC report highlights that out of the 169 SDG targets, 102 have evidence of connections to urban ecosystems, underscoring the centrality of cities in achieving global sustainability (Lwasa et al., 2022). Likewise, the Paris Agreement (2015) explicitly calls for action by “all levels of government,” while initiatives such as UN-Habitat's New Urban Agenda (2016), the UNFCCC's Race to Zero (2020), and related transnational networks (e.g., ICLEI) reinforce the growing recognition of subnational and local governments as indispensable actors in addressing climate change (CDP & ICLEI, 2021; UN-Habitat, 2022). Finally, the IPCC's decision to prepare a dedicated Special Report on Climate Change and Cities within its next Seventh Assessment Cycle (AR7), scheduled for release in 2027, even further cements the growing international focus on urban settlements as essential components of the global climate response (Bai, 2023; Lwasa et al., 2022).

This attention to cities and other subnational actors stands out even more when contrasted to the insufficient action at higher levels of governance. While the climate change agenda has been largely dominated by international agreements and national frameworks, action by the nation-states has been underwhelming and inconsistent (e.g., most countries failed to deliver on their Kyoto commitments) (Lee & Koski, 2012), with current national policies being “highly insufficient to limit global warming to 1.5 °C” (*Climate Action Tracker*, n.d.; NewClimate Institute, 2021). Indeed, in recent years, we have seen not only a lack of commitment at the national level but also cases of outright backtracking, most notably exemplified by the United States' second withdrawal from the Paris Agreement (The White House, 2025). Despite this, many mayors from American cities pledged to continue their climate initiatives (Climate Mayors, 2025a). Meanwhile, research shows that action by non-state actors (e.g., cities, regions, businesses) can not only help countries “achieve or over-achieve” their Paris Agreement national commitments, but also inspire them to raise their ambition, or even, for those countries that withdrew, to “partly make up for backtracking” (Kuramochi et al., 2020).

It is therefore unsurprising that, in the context of climate action, subnational actors (including local governments) receive considerable attention in both academic and practitioner circles. They are emerging as vital actors, well-positioned to translate global ambitions into concrete outcomes on the ground. The local level is where “interactions among authorities, institutions, and citizens are strongest and most immediate,” and is the level positioned as “the most proximate socio-institutional setting that directly affects individual and collective capabilities” (Biggeri, 2021).

While actors (both public and private) active at the local level are numerous, urban (municipal) policymakers themselves play key roles in governing and facilitating low-carbon transitions. They act as “target setters and planners, demand aggregators, regulators, operators, conveners, and facilitators for coordinated planning and implementation” (Lwasa et al., 2022), active at the level most immediate to local constituencies and practical implementation of measures on the ground. Studying local government officials and their governance of climate action is therefore essential for both theoretical and practical understanding. Against this background, this dissertation positions local authorities as major actors and objects of the research.

1.1.2 The Local Net Zero Commitments Trend and the Case of Japan

In recent years, the concept of net zero has become a central focus of policy discussions on climate change. It describes a condition in which human-caused greenhouse gases¹ are balanced by their equivalent removals within a defined period (IPCC, 2022a). Achieving this balance globally by mid-century (at the latest) is now widely regarded as a precondition for limiting global temperature rise to 1.5 °C above pre-industrial levels, as articulated in the Paris Agreement (2015) (IPCC, 2023).

Even before the net-zero concept was popularized, a few pioneering cities around the world, such as Copenhagen, Stockholm, Vancouver, and Portland (OR), among others, had long been recognized for setting ambitious emissions reduction goals early on. However, it was in the late 2010s and early 2020s—building on the international momentum established by the Paris Agreement (2015), the 2030 Agenda for Sustainable Development (2015), and the release of the IPCC’s landmark Special Report on Global Warming of 1.5°C (2018)—that the concept of “net-zero carbon cities” (or “net-zero cities” for short) gained significant momentum globally (Net Zero Tracker, 2024; NewClimate Institute, 2021; Seto et al., 2021; UN Climate Change High-Level Champions, 2024). Also known by different names such as carbon-neutral cities, zero-carbon cities, climate-neutral cities, or other variations, a common premise uniting these cities is that they are committed to substantially reducing their emissions within their territories to levels balanced by their carbon sinks (e.g., green areas, bodies of water) (Seto et al., 2021).

Indeed, what was once a pioneering practice pursued only by a few city leaders with bold goals has become a broader trend in the late 2010s and early 2020s. During this period, many more subnational (local and regional) governments have made official commitments indicating their ambitions to act on the changing climate. These include climate emergency declarations (CEDs) and pledges that set and commit to achieving the net-zero goal itself (i.e., net-zero commitments). The former are formal acknowledgments of the urgency to act, made by government leaders (e.g., mayors, governors), which may include official emission reduction targets or remain broader

¹ Or carbon dioxide, depending on the commitment/goal

political commitments without numeric targets (Davidson et al., 2020; Gudde et al., 2021; Ruiz-Campillo et al., 2021). The majority of emergency declarations were made between 2019 and 2022, and to date, the number is approximately 2,300 jurisdictions (*Cedamia*, 2025; climateemergencydeclaration.org, 2025). The latter are the commitments that go beyond political signaling (at least, presumably so) and establish the actual net-zero targets, albeit with varying time horizons (most often by 2050) and scopes (e.g., all greenhouse gases or CO₂ only). The UN-FCCC’s Race to Zero campaign currently counts around 1,100 member cities with pledges to achieve net zero by 2050 (UN Climate Change High-Level Champions, 2024). Yet, the actual number of cities committed to net zero is certainly much larger, as many indicate their commitments within national frameworks rather than necessarily becoming members of international conventions. This is exemplified by Japan’s case described below.

Japan presents a particularly instructive case of a country with a large number of net-zero-committed local and regional jurisdictions. Such commitments rapidly reached large numbers within just a few years. Starting in 2019, numerous subnational governments have committed to reaching net-zero carbon dioxide emissions, with 80% of the population covered by these commitments as early as 2021. By 2023, the number reached over 1,000 jurisdictions—representing more than 95% of the population (MOE, n.d.-c).² Under a framework set by the Ministry of the Environment (MOE), these areas are called “Zero Carbon Cities” [ゼロカーボンシティー], which include municipal and regional (prefectural) governments that voluntarily aim for net-zero CO₂ emissions³ by 2050 or sooner (MOE, n.d.-c). Interestingly, this ground-up movement started before the national government announced its Carbon Neutrality Goal in October 2020 (Prime Minister of Japan and His Cabinet, 2020). By that time, 166 local governments had already made commitments, even though most followed afterward (MOE, n.d.-c). Researchers have noted that, unlike many proactive local authorities, the national government initially appeared hesitant to elevate its climate targets (Ota & Akagi, 2021). Some scholars argue that the swift spread of Zero Carbon Cities helped build bottom-up momentum, ultimately swaying the national pledge (Nakazawa et al., 2023).

In other East Asian countries, local climate action commitment movements have also been notable, although their approaches vary. In China, climate targets are typically assigned to subnational governments through a top-down approach, with national quotas scaled down to localities.

² It should be noted, however, that population coverage in that statistic by MOE was counted based on committed subnational governments, which include prefectures (regional governments); hence the population covered by municipal governments would be smaller, yet still substantial.

³ Official Japanese government materials predominantly frame “Zero Carbon City” commitments as achieving CO₂ net-zero by 2050. However, some MOE policy documents and municipal declarations use broader wording referring to greenhouse gases (GHGs) or CO₂, indicating minor variation in scope across official sources.

At the same time, local leadership is also promoted through the national "low-carbon pilot" program, which allows ambitious provinces and municipalities to apply for designation and receive support (NEASPEC, 2021). South Korean local governments adopted a unified stance, declaring a joint climate emergency in June 2020 (ICLEI Network et al., 2020) and subsequently releasing a joint "2050 Carbon Neutrality Joint Declaration" in May 2021 (The Ministry of the Interior and Safety, 2021). In contrast, however, Japan's approach has been more individual and largely bottom-up. Japanese local governments have been making their net-zero declarations on an individual basis, each setting its own targets and issuing independent announcements of its commitments.⁴ Ostensibly, such an approach demonstrates a good deal of municipal autonomy – i.e., a degree of "institutional political leeway" (NEASPEC, 2021) – which allows local governments in Japan to define their own strategies, priorities, and timelines. This shows that many municipalities in Japan are setting themselves net-zero targets at their own volition, indicating their self-determination and enthusiasm for pursuing climate policy.

With this backdrop, Japan presents itself as an intriguing setting to explore the subnational net-zero movement. It is a rare case of a country where over a thousand local governments now have net-zero commitments. These local authorities have been announcing their pledges individually, from the bottom up, since 2019 up to the present moment (2025-2026), and have gradually come to cover the majority of the country's population of over 120 million people. Japan thus provides a large and diverse sample of net-zero-committed cities of various sizes, geographies, capacities, and socio-economic settings, which are also driven by diverse local motivations and face a diverse set of challenges (and, similarly, are enabled by various conditions conducive to action). Japan thereby offers immense potential for empirical investigations that may attempt to explore, on a large scale, the conditions that inspire, obstruct, and enable local climate governance across various municipal settings. Such investigations may thus derive generalizable insights not only for Japan but also beyond it, given the large populations covered by net-zero pledges across numerous varied local municipal contexts.

Importantly, these net-zero commitments in Japan are not legally binding obligations. They are generally issued as public policy declarations rather than enforceable statutory mandates (MOE, n.d.-a). Although municipalities are legally required under the Act on Promotion of Global Warming Countermeasures to formulate Climate Action Plans, the explicit adoption of a net-zero target within such plans remains voluntary (MOE, n.d.-b).

This institutional arrangement creates a striking paradox. More than one thousand local governments have publicly committed to ambitious long-term decarbonization goals without

⁴ Group declarations are also present in Japan, but they usually combine a few neighboring municipalities united by a particular regional interest or logic, which contrasts with the South Korean all-in nationwide municipal commitment

formal legal compulsion or enforcement mechanisms. Yet the absence of binding requirements may also weaken incentives for sustained implementation and accountability. The coexistence of widespread voluntary commitment and persistent implementation gaps raises a fundamental question about what drives, sustains, or constrains local climate action in practice—an issue explored in the following section.

1.2 Problem: Inadequate Local Climate Governance and Its Understanding

1.2.1 Despite Rhetoric, Action Remains Insufficient – What Drives or Impedes Local Action?

Despite the trend of increased adoption of net-zero commitments by subnational actors in the late 2010s and early 2020s, it remains inadequate and uneven given the scale of the emissions reduction gap globally (UNEP, 2024). There are serious questions raised about whether these committed parties are actually following through on their pledges, and the so-called “action gap” (or “policy gap”) remains a looming concern despite the rhetoric (Net Zero Tracker, 2024; NewClimate Institute, 2021; United Nations Environment Programme et al., 2024).

Furthermore, in recent years, there has been a palpable slowdown of the net-zero commitment trend, and major political shifts have led to backsliding on existing commitments (Schonhardt, 2025; *Warming projections global update*, 2025). Local jurisdictions with newly declared climate emergency declarations (CEDs) have turned to null by November 2024 (*Cedamia*, 2025), while net-zero declarations by cities have similarly slowed significantly (UN Climate Change High-Level Champions, 2024). In Japan, the total number of declared subnational governments reached 1013 by the end of 2023, 1130 by the end of 2024, and 1196 by the end of 2025, indicating a clear slowdown trend (though not a complete halt) (MOE, 2025).

These concerns underscore the importance of clarifying and reinforcing compelling motivations—strong enough to inspire and drive local actors forward—while simultaneously fostering a conducive environment for progress by strengthening key enablers and addressing critical barriers. All these elements are necessary to ensure stronger and more consistent progress. In other words, how to ensure that urban actors are both compelled to act on achieving the net-zero cities and have the necessary ability to act on it?

In Japan, the widespread voluntary adoption of net-zero commitments by local governments, including many made before the national pledge, suggested the presence of strong motivations driving local authorities. They could potentially stem not only from external pressures but also have intrinsic origins. Indeed, scholars have long noted that, given the largely voluntary nature of climate goals, cities' commitments seem to be strongly guided by self-determined internal priorities and considerations (Anguelovski & Carmin, 2011).

Existing research investigated *what* potential determinants (i.e., specific city characteristics such as socio-economic, geographic, etc.) are likely to stand behind, for instance, climate action

plans development in European cities (Reckien et al., 2015). More recently, research explored determinants behind the domino-like diffusion of Zero Carbon City commitments in Japan, identifying both internal factors (e.g., resource endowments, political leadership) and external ones (e.g., pressure from neighboring cities' declarations or from senior government levels) (Nakazawa et al., 2023). However, what remains less explored is *why* (in addition to the goal of mitigating climate change per se) local authorities aspire to pursue net-zero emissions? In other words, which specific intrinsic motivations, rooted in their own agency, priority objectives, or perceptions of benefit, attract and drive cities forward?

Understanding these motivations is essential not only to explain why municipalities commit to net zero in the first place but also to shed light on what drives and supports their implementation efforts. Given the current negative trends (i.e., the slowing down of net zero commitments, lack of follow-through, and outright backtracking, as mentioned above), getting a clear grasp of the considerations that inspire and drive local governments to pursue climate action will be key to ensuring the local efforts are on track to deliver progress and not revert to the status quo.

The literature notes that such motivations often stem from perceived benefits and opportunities of climate action, which can inspire and drive local initiatives (Bain et al., 2016; Scanu & Cloutier, 2015). Municipalities may, for instance, be strongly motivated by the potential to improve air quality (by reducing air pollutants simultaneously with GHGs) (Lwasa et al., 2022, p. 875; Williams, 2012); by prospects for cost savings and added value from energy efficiency measures and building retrofits (Lee & Koski, 2012); or by various other co-benefits associated with climate action (Floater et al., 2016). Alternatively, motivations may also arise from concerns about climate-related risks, past experiences with natural disasters, or a broader altruism-driven desire to join efforts for the global good (Ruiz-Campillo et al., 2021).

In addition to encouraging undecided local governments to join the effort and strengthening implementation, strong, compelling motivations also highlight potential synergies between climate and non-climate objectives (i.e., win-win strategies), thereby fostering stronger and broader stakeholder support. For instance, as this dissertation goes on to demonstrate, many municipalities view climate action as a way to address local concerns, thereby helping to achieve a stronger and broader consensus among actors and to unify collective capacities towards action.

At the same time, while motivations are key, they are not sufficient on their own. Even when municipalities are driven by strong ambitions and aspirations, they often encounter a range of roadblocks and may lack the necessary capacities or enabling environment to act. Various barriers, such as insufficient funding (Aylett, 2014; Lwasa et al., 2022; UN-Habitat, 2022, pp. 105, 260), inadequate data management systems (Bulkeley et al., 2009; Jones, 2017; D. Ryan, 2015), an unsupportive regulatory environment (Bulkeley et al., 2009; Lee & Koski, 2012; van der Heijden, 2019) and numerous other obstacles can significantly impede progress. Conversely,

municipalities may recognize and highly value certain enabling conditions that support or accelerate climate action, whether these conditions are currently in place or not. For instance, the presence of a dedicated climate champion among local leadership (e.g., a mayor), who can mobilize resources and unite stakeholders, is widely viewed as improving the likelihood of effective action (Bulkeley, 2011; Krause, 2011; van der Heijden, 2019). Policies are much more likely to succeed if critical barriers are mitigated and enablers are brought into play (Steg et al., 2022).

Overall, understanding the dynamics of local climate progress (or lack thereof) requires considering both the conditions that influence local governments' ability to act (i.e., barriers and enablers) and the factors driving local actors' interests and ambitions (i.e., motivations) (D. Ryan, 2015). As the dissertation unfolds, it becomes clear that these aspects are not only important as independent concepts but also integral to a holistic understanding of local climate governance. Such a holistic understanding is crucial to avoid narrow, ineffective one-off measures and to craft comprehensive, strategic interventions that ensure stronger progress toward climate objectives.

1.2.2 Motivations, Barriers, and Enablers to Net-Zero Cities: Research Gaps and Questions

As argued in this dissertation, understanding motivations, barriers, and enablers (MBEs) to local climate action is essential for ensuring the effective conduct of climate governance and achieving tangible progress on the ground. While mostly studied separately, MBEs are generally acknowledged by scholars and practitioners alike as vital aspects pertaining to the field of urban climate governance (Dubash et al., 2022).⁵ Indeed, IPCC's *Mitigating Climate Change* (2022) report notes that drivers and obstacles of climate action are a “*key source of uncertainty*” when it comes to efforts by subnational actors (Lwasa et al., 2022).

Scholarship on local climate governance has been growing in recent decades, and some of it has explored motivations, barriers (or “challenges”), and enablers (or “drivers”) of local climate action (Aylett, 2014; M. M. Betsill, 2001; Bulkeley et al., 2009; Krause, 2013; Reckien et al., 2015; Romero-Lankao et al., 2018; D. Ryan, 2015; Salon et al., 2014; Scanu & Cloutier, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019). Yet, the knowledge remains insufficient, fragmented, and gaps abound. They stem not only from a lack of studies on the topic, but also from several tendencies and biases that prevail in the existing literature, including those of methodological, empirical, and conceptual nature. This dissertation seeks to contribute to the field by addressing these gaps.

⁵ Urban (or Local) Climate Governance is a field that explores how different actors and institutions manage the planning and implementation of climate action at the local level (Anguelovski & Carmin, 2011; Bulkeley, 2010; Joss, 2015; Romero-Lankao et al., 2018).

1.2.2.1 First Gap: The Need to Address the Fragmented State and Bias in Existing Knowledge

To be able to act on the factors influencing local progress on climate, studies need to reveal them in the first place (Denton et al., 2022). Substantial progress has been made in identifying and cataloguing numerous MBEs of local climate action that scholars have encountered in their investigations. Despite such progress, however, knowledge on MBEs to climate action by cities remains scattered due to two primary tendencies within existing research.

On the one hand, scholars (e.g., Aylett, 2014; Bulkeley, 2010; van der Heijden, 2019) argue that most scholarship derives factors from context-specific case studies, resulting in a lack of generalizable insights and a widely applicable analytical framework. On the other hand, a few review studies attempted to consolidate existing knowledge, producing broader lists of relevant MBE items commonly identified across disparate publications. For instance, Sippel and Jenssen (2009) derived a comprehensive overview of motivations and challenges from over 90 academic articles (Sippel & Jenssen, 2009), and van der Heijden (2019) summarized knowledge on common enablers from 260 publications (van der Heijden, 2019). Likewise, a few climate urban-oriented reports feature chapters summarizing challenges or potential enablers associated with effective urban climate governance (e.g., Romero-Lankao et al., 2018). However, while these overviews provide useful insights into broad collections of possible factors, their applicability remains limited without feedback on the salience of these factors from practitioners, such as city officials. Indeed, some scholars (Biesbroek et al., 2013) caution that lists of potentially relevant factors could be “endless”. Relatedly, Ryan (2015) warns of “a tendency for the literature on climate change and urban issues to fall into the ‘everything matters’ trap” (D. Ryan, 2015). These critiques underscore the importance of assessing not only the existence of these factors but also their relative significance and severity, including how they are perceived by local actors whose views are shaped by practical, on-the-ground realities.

To put it simply, the above describes a situation in which our current understanding of local climate governance falls into one of two opposing extremes – either too contextual to generalize (case studies) or too generic to be insightful or convincing (non-empirical literature reviews or conceptual studies).

Further adding to this unsatisfactory state are three common biases in the existing literature: (1) an overemphasis on climate frontrunners, (2) an overrepresentation of Western cities, and (3) a shortage of large-sample, survey-based research. First, conventionally, most studies have focused on frontrunner cities—pioneers of climate action—rather than typical municipalities, leading to a skewed knowledge base that is predominantly derived from research on affluent and high-capacity cities (Bulkeley et al., 2009; Castán Broto & Bulkeley, 2013; van der Heijden, 2019). Relatedly, van der Heijden warns of a “frontrunner paradox” (i.e., when the ambitious rhetoric of

so-called front-runners often fails to match their actual performance), addressing which requires studying typical municipalities representing a broader spectrum of urban governance contexts (van der Heijden, 2019, 2021; van der Heijden et al., 2019). More studies in Japan, which has the majority of its population covered by Zero Carbon City commitments, would enable the exploration of larger, all-encompassing (rather than exclusively high-capacity, frontrunner) municipal samples to generate more generalizable insights.

Second, urban climate governance research continues to be dominated by cases from Europe and North America, as scholars have consistently highlighted (Blok, 2016; Bulkeley, 2010; Bulkeley et al., 2009; van der Heijden, 2019). Echoing broader advocacy for post-Eurocentric, cosmopolitan social science (Beck & Sznaider, 2006), Blok (2016) calls for more urban climate research (especially empirical investigations) in East Asian cities, where climate risks and policy responses are rapidly intensifying (Blok, 2016). Indeed, there seems to be limited exploration of Japan's perspectives on these key governance issues. While some recent studies have examined, for instance, the diffusion of Zero Carbon City commitments in Japan (Nakazawa et al., 2023), few offer systemic insights into municipalities' motivations, barriers, or enablers to climate action.

Third, very few studies collect a large volume of original primary data directly from numerous municipalities at scale, for instance, by employing questionnaire surveys to capture practitioner perspectives from dozens (or even hundreds) of municipalities. A few of such large earlier surveys (e.g., Aylett, 2014; Krause, 2013; Salon et al., 2014) were conducted prior to the net-zero trend, often focusing on municipalities affiliated with transnational city networks (e.g., ICLEI)—considered pioneers by some scholars (Kern & Alber, 2009; van der Heijden, 2019)—or municipalities within leading subnational jurisdictions, such as those in California.

Given the above biases, there is a dearth of studies that explore broader cross-sections of local governments of varying capacities and across diverse contexts at scale, particularly in under-researched geographies, for instance, Japan.

Given the unsatisfactory state of the existing body of literature, there is a need for further systematization and organization of knowledge on urban climate governance—specifically, to identify and map the key motivations, barriers, and enablers (MBEs) that municipalities face as they strive to reach net-zero goals. To better organize the field, research needs to systematize long catalogues of commonly identified and most relevant MBEs into a coherent, streamlined analytical framework. As explained above, such a systematization effort also needs to be supported by strong empirical data reflecting the importance of those factors, preferably drawn from a large pool of city cases (i.e., large-N studies). Although studies may examine various urban actors, research on the perceptions of local officials responsible for net-zero city policies—who are key planners and decision-makers—would be particularly instructive.

To bridge the above gap and contribute to the knowledge systematization, it is hence necessary to conduct a large-N study targeting numerous committed local authorities—preferably in understudied geographies, such as Japan—and investigate the following research question:

Which motivations, barriers, and enablers do local authorities identify as most salient in their efforts to fulfill net-zero commitments?

1.2.2.2 Second Gap: The Need for Large-N Qualitative Inquiry into Municipal Perspectives

While revealing which particular factors are salient in local climate governance is a necessary first step (Denton et al., 2022), research needs to move further than that – towards understanding *why* exactly they are salient and *how* barriers can be addressed, enablers strengthened, and motivations leveraged for advancing net-zero cities. As Biesbroek et al. (2013) argue, the central task for future research is shifting from cataloguing *which* barriers exist to asking the more analytical questions of *why* and *how* (Biesbroek et al., 2013). Although their comment concerns barriers, the same holds for motivations and enablers: mere descriptive lists and catalogues of factors are insufficient to guide meaningful action.

Scholars have repeatedly noted that existing studies remain largely descriptive, producing long lists of generic obstacles or drivers but rarely investigating the interpretive reasoning behind them (Eisenack et al., 2014). Burch (2010a) emphasizes that the “ultimate goal” is not only to identify barriers but to understand how they might be overcome and even transformed into enablers of action (Burch, 2010a). Achieving this requires not just statistical assessments of factors but also insight into the narratives, framings, and interpretations that shape municipal decision-making and reveal important interpretive details about *why* such factors actually matter (which, in turn, would give hints into *how* they can be addressed/leveraged).

Yet the literature offers surprisingly little qualitative insight into MBEs at scale. A few large-N survey studies of local climate governance explored the prevalence of particular motivations, barriers, and enablers (e.g., Aylett, 2014; Krause, 2013; Rhodes et al., 2021; Salon et al., 2014). However, their designs typically relied on closed-ended questionnaires and quantitative descriptive analysis, revealing *what* factors practitioners encounter by reporting the response frequencies, but remaining silent on *why*, not probing the reasoning behind responses. Apart from Rhodes et al. (2021), few studies combined quantitative instruments with open-ended inquiry to reveal why respondents prioritized one factor over another or how those factors were understood within their institutional and socio-political contexts. Consequently, these studies produced valuable lists of commonly encountered factors but lacked the explanatory depth needed to capture the complex, subjective reasoning of municipal decision-makers.

To move the field forward, it is necessary to bridge measurement with meaning—to link the statistical identification of salient factors with qualitative insight into how practitioners frame

and experience them. However, most qualitative research on local climate action relies on small-N case studies or interviews, yielding rich contextual detail but limited generalizability. Conversely, large-N quantitative analyses achieve breadth at the expense of interpretive nuance. Attempts to combine both have typically adopted a sequential mixed-method design, where quantitative analyses of objective city attributes (e.g., population, income) on the outcome (e.g., adoption of a climate action plan or net-zero declaration) are followed by a handful of qualitative case studies for illustration (e.g., Krause, 2013; Nakazawa et al., 2023). Such designs, while useful for examining associations, are not well suited to capturing the aggregate patterns of practitioners' perceptions because the qualitative dimension rests on a narrow empirical base (i.e., few cases).

What remains missing, therefore, is a *large-N qualitative inquiry*—an approach that maintains the *generalizability* of survey research while achieving the *interpretive depth* usually found in case studies. Such research would directly collect and systematically analyze open-ended responses from hundreds of municipalities, making it possible to derive qualitative insights at an aggregate, large-scale level and uncover common reasoning patterns across diverse contexts.

Responding to this gap requires more studies with qualitative or mixed-methods designs that inquire into a large sample of cities, aiming to collect sizable qualitative response data. Analyses of such rich and large-scale qualitative data would allow answering the following research question:

How do committed municipalities rationalize and contextualize their most salient motivations, barriers, and enablers toward achieving net-zero cities, and what commonly shared reasoning patterns emerge across numerous different municipal contexts at scale?

1.2.2.3 Third Gap: The Need for an Integrated, Dynamic, and Holistic Understanding of MBEs

Even if we know *which* motivations, barriers, and enablers (MBEs) matter most to municipalities, and even if we understand *why* practitioners perceive them as important, a central challenge remains: *how do these factors interact with one another to shape actual progress or inertia?* To date, current research offers little guidance on this question.

Most studies examining various barriers continue to treat them as separate items—examined in isolation, enumerated in lists, or explored in-depth within narrow case studies. Yet existing scholarship repeatedly cautions that they are neither independent nor static. Scholars mention that barriers are “deeply interwoven phenomena”, each having a property to “reinforce one another,” often creating gridlocks of path-dependency and institutional inertia (Burch, 2010b). The implication is that different obstacles cannot be fully understood on their own because “one barrier may give rise to another,” and interventions that focus on a single issue can have “limited or even no effects” if related proximate barriers remain unaddressed (Eisenack et al., 2014; Steg et al., 2022).

Similarly, enablers seldom operate in isolation. As the IPCC stresses, urban mitigation outcomes “involve the interplay of multiple enablers and barriers” (Lwasa et al., 2022) and “there is rarely any one single factor” preventing or advancing transitions toward low-carbon futures (Denton et al., 2022). Rather, transformative progress emerges from “strengthening complementarities and synergies” across governance levels and actor groups, not from isolated, linear policy interventions (Denton et al., 2022).

Despite such warnings, the field lacks a coherent, integrative framework capable of capturing these interdependencies (Burch, 2010b; Eisenack et al., 2014; Steg et al., 2022). Existing research oscillates between two extremes: either static typologies and high-level lists that identify numerous factors but overlook their interrelationships, or in-depth but narrow case studies that reveal interactions of a few factors within specific contexts, but cannot be generalized broadly.

What is missing is a systemic, holistic perspective—one that treats motivations, barriers, and enablers as components of a single governance system whose behavior emerges from dynamic relationships. Such a perspective would reveal not only standalone influences (e.g., lack of funding) but also configurations of mutually reinforcing conditions that produce either inertia or momentum. As Ryan (2015) argues, climate governance scholarship must adopt a more “configurational approach,” recognizing that “the effect of any particular condition may depend on the presence or absence of others” (D. Ryan, 2015).

Finally, the field has yet to meaningfully integrate motivations into this systemic lens. Motivations are typically studied as reasons municipalities act, but the role of motivations in relation to either barriers or enablers, and in shaping municipal existing local capacities towards action, remain unexplored. Without this integration, our understanding of local climate governance remains incomplete.

Together, these issues point to the need for an integrated heuristic that:

- 1) Brings motivations, barriers, and enablers into a single conceptual structure;
- 2) Depicts how these factors interact across governance levels and actor groups;
- 3) Identifies reinforcing cycles of progress or inertia; and
- 4) Is practical and flexible enough to be used by scholars and municipal practitioners.

Addressing such a knowledge gap requires more integrative studies that attempt comprehensive explorations of the interplay among factors, leading to a conceptual synthesis and the creation of usable, holistic frameworks. Such research would investigate the following questions:

How do motivations, barriers, and enablers interact and reinforce one another to shape municipal progress or inertia toward net-zero, and how can these dynamics be conceptualized within a holistic, practical framework?

1.2.2.4 Fourth Gap: The Need for More Transdisciplinary Study Designs

A final and increasingly recognized gap concerns the mode of inquiry itself: not *what* is studied, but *how* it is studied. Addressing climate change requires a process that is a deeply social and multi-actor endeavor, where government officials, businesses, civil society groups, youth, residents, and academic institutions engage with one another to co-produce knowledge and take collective action. Yet, conventionally, most academic research treats itself as an *impartial outsider*—observing, measuring, or critiquing—but rarely participating directly. This creates a disconnect between scholarly analysis and the practical realities on the ground.

Sustainability transitions scholarship argues that bridging this divide and enabling collective action requires “a fundamental paradigm shift,” moving beyond the linear model of knowledge production toward more collaborative, participatory, and action-oriented forms of inquiry (Denton et al., 2022). This is where the *transdisciplinary* research theory has been gaining traction. Rather than positioning researchers as external observers, it argues for actively integrating academia with other societal “thought collectives” and their diverse “thought-styles” into processes of joint problem framing, shared learning, and knowledge co-creation (Pohl, 2011; Pohl et al., 2010). Such research shifts attention from a descriptive–analytical “knowledge-first” approach towards more “process-oriented” action-research, with the researcher herself taking a variety of roles: from that of a *classic scientist* to more *mediation* and *facilitation* roles, and even to a direct *agent of change* (Wittmayer & Schäpke, 2014).

However, approaches like these remain a novelty and are still rare. The discussions behind the application of transdisciplinary research remain abstract and largely theoretical. In addition, there is a lack of institutional backing for such inquiry, nor is there easily digestible practical guidance for early practitioners.⁶ All this results in transdisciplinary research being left to sophisticated enthusiasts rather than becoming part of mainstream graduate education. In practice, this means that academic research misses opportunities for mutual learning, knowledge co-creation, and real-world impact.

Addressing this gap requires examining how researchers can operationalize transdisciplinary principles in practice, such as through immersive fieldwork, participatory engagements, creation of spaces for multi-stakeholder dialogue and interaction of diverse “thought collectives”, and direct contributions to societal learning. It also requires investigating what forms of *catalytic, process-oriented activities* (advocated by transdisciplinary scholars) are feasible and meaningful within the constraints of doctoral research, as well as what curriculum innovations in graduate settings can support such endeavors.

⁶ From author’s own personal experience

With this backdrop, there is a need for more studies that incorporate transdisciplinary elements into their designs, striving to co-create knowledge with societal actors. Researchers in such studies would experiment with societal engagement by taking various action-oriented roles (from *impartial inquirer* to *mediator* and *change agent*), traveling and acting in both academic and societal domains; thus impacting both.

1.3 Addressing the Gaps through a Multi-Faceted Integrative Research

1.3.1 Overview of Research Questions:

With the background and research problems established in the previous sections, in this dissertation, I aim to bridge the identified gaps by addressing the following overarching research question:

What motivates municipalities to pursue net-zero goals, what impedes and enables their progress, and how do these factors interrelate and form a coherent whole that shapes local climate governance?

This overarching question is explored through three subsidiary questions:

1. What are the most salient motivations, barriers, and enablers (MBEs) perceived by local authorities across a large number of Japan's net-zero-committed cities?
2. Why do these factors matter to authorities—how do they rationalize and interpret their significance within their local contexts? What common themes emerge?
3. How do these factors interact and reinforce one another, forming patterns of progress or inertia within the system of local climate governance, and how can these dynamics be captured within a holistic framework?

Together, these questions move from identifying *what* MBEs matter to net-zero cities, to explaining *why* they matter, and finally to uncovering *how* they interplay in both practice and theory.

1.3.2 Research Objectives and Logic of the Inquiry

Building on the research questions outlined above and the gaps identified in the previous section, this dissertation unfolds as a multi-stage inquiry aimed at clarifying what motivates, obstructs, and enables local climate action—and how these elements interact and combine within a holistic system. The study follows a logical progression that moves from identifying and prioritizing factors, to uncovering their underlying reasoning, to engaging in practice through transdisciplinary collaboration, and finally to synthesizing all strands of evidence into a comprehensive, integrated model. The dissertation thus unfolds along a sequence of four specific major objectives:

- (i) Clarify what factors matter: establish a conceptually and empirically grounded map of key municipal motivations, barriers, and enablers.

While many studies have identified potential factors that motivate, obstruct, or enable municipal climate action, their findings remain dispersed across narrow case studies and broad high-level overviews without a generalizable empirical basis. To provide a stronger conceptual foundation, the study first consolidates this scattered knowledge into a structured analytical framework of motivations, barriers, and enablers (MBEs) synthesized from the literature. Building on this, it empirically distills—through a large-scale survey of Japan’s 489 Zero-Carbon-committed municipalities—the key MBEs that local practitioners themselves perceive as most salient. The result of this dual conceptual–empirical effort is a coherent map of “what matters most” to local officials pursuing net-zero objectives, grounded in both a large body of literature and substantial empirical evidence. Such effort narrows down the list of numerous MBEs identified in existing literature to a more manageable picture of the most salient factors, thus avoiding the “*everything matters*” problem in urban climate governance research (D. Ryan, 2015) and focusing attention of both scholars and practitioners toward areas of highest strategic relevance.

- (ii) Explain why they matter: uncover municipal interpretations and reasoning at scale.

Statistical identification and prioritization of MBEs alone is insufficient for in-depth understanding and devising effective strategies that address or leverage these factors. It is important to complement the ranking of factors with an in-depth contextual understanding of why they matter and how municipal actors make sense of them. To that end, the research collects and analyzes a large volume of qualitative data (nearly one thousand open-ended municipal reflections) to capture the reasoning, interpretations, and contextual framings behind the identified factors. Such large-N qualitative inquiry bridges the depth of case-based insight with the breadth of survey-based representation—an approach rarely attempted at this scale. This approach paves the middle path between context-deprived generalizations on the one hand and overly contextual case study investigations on the other, toward a comprehensive, empirically grounded, nuanced understanding.

- (iii) Unite academic and societal knowledge creation: engage with transdisciplinary inquiry.

Recognizing that climate governance is fundamentally a shared social endeavor, the dissertation also explores how research itself can make a social impact. To that end, this dissertation incorporates transdisciplinary elements into its design: engaging directly with urban practitioners in the field, facilitating dialogues through an international multi-stakeholder forum, and experimenting with action-oriented and educational outreach. These efforts bridge academic inquiry with the lived realities, diverse ‘thought-styles’, and experiential knowledge of local actors. Spanning the entire research process, these transdisciplinary activities generate reciprocal benefits: they

inform the empirical research (survey) design and its findings, support knowledge co-creation, and contribute direct societal value by fostering dialogue, awareness, and engagement.

(iv) Integrate all evidence (empirical findings, practical experience, and existing knowledge) into a holistic and usable conceptual model.

The final objective is to synthesize the entire body of evidence—statistical patterns, qualitative interpretations, insights gained through transdisciplinary engagement, and relevant existing scholarship—into a single, coherent structure that clarifies how motivations, barriers, and enablers interact within a holistic system. By developing such a conceptual model, the dissertation aims to provide both: (1) a system-level understanding of how progress or inertia emerges, and (2) a practical, flexible tool to help cities make sense of their climate-action barriers and craft effective strategies that leverage multiple enablers and motivations.

By setting these objectives, the research thus adopts a multi-faceted approach, which is comprehensive in scope (exploring numerous MBEs in a single study), empirically rich (large-N original dataset), analytically rigorous (employing a mixed-method methodology), epistemologically diverse (experimenting with transdisciplinary theory and practice), and integrative in nature (striving towards a holistic understanding).

1.4 Structure of the Dissertation

The structure of the dissertation follows the above objectives and logic of inquiry, with each chapter corresponding to a major stage in the research process and collectively forming a coherent progression from laying out the conceptual foundations, to empirical inquiry and analysis, to reflection and the overall synthesis (with transdisciplinary engagements running throughout the whole research process).

Chapter 2 – Analytical Framework

The study begins by building an analytical foundation. This chapter synthesizes and organizes the existing scattered body of scholarship on municipal motivations, barriers, and enablers (MBEs) of climate action. Drawing from a wide range of literature, it identifies and consolidates recurring mentions of factors into three lists—(1) Motivations, (2) Barriers, and (3) Enablers—highlighting the most commonly cited factors in the existing literature. Further, drawing on insights from the literature, the chapter develops an Integrated Analytical Framework: a conceptual depiction that integrates the three theoretical domains (Motivations, Barriers, and Enablers) into a single schematic, illustrating their potential interconnections at a broad abstract level. This framework serves both as a theoretical grounding for the empirical work that follows and as a reference point for later analysis and synthesis.

Chapter 3 – Research Design and Survey Implementation.

Building on the analytical framework, Chapter 3 introduces the methodological design of the empirical study. It describes the overall mixed-method survey structure, sampling frame, and implementation process, outlining how quantitative and qualitative data were collected concurrently by targeting a sample of Japan's 489 municipalities that have declared *Zero Carbon City* commitments. The survey structure was carefully designed to capture both quantitative and qualitative dimensions of practitioner experience—beginning with factor evaluations, proceeding through single-item prioritization, and concluding with open-ended reflections. This mixed-format instrument enabled a balance between breadth and depth, engagement and precision, ultimately yielding one of the most extensive datasets on municipal climate governance to date.

Chapter 4 – Quantitative Data Analysis Findings and Discussion.

The fourth chapter presents the results of the quantitative analyses of survey data. It identifies which MBE factors municipal officials perceive as most significant, revealing dominant motivations, persisting barriers, and promising enabling conditions. Correlation analysis further uncovers associations among factors, hinting at the interrelationships that may underlie the dynamics of local climate governance. The chapter situates and discusses these findings within the literature in the field before concluding with the bird's-eye view of the highest-ranked MBEs. The chapter thus establishes a quantitative empirical baseline for the subsequent analyses.

Chapter 5 – Thematic Analysis of Qualitative Responses.

Deepening the understanding, Chapter 5 turns to the open-ended survey responses. It examines nearly 1,000 textual responses from municipal officials, using thematic analysis to uncover how practitioners rationalize and contextualize their most significant MBEs. This approach bridges the interpretive richness of qualitative inquiry with the representativeness of large-sample survey research. In doing so, it explores the collective interpretive logic behind municipalities' assessments, uncovering the common reasoning, framings, and local narratives that explain why certain factors hold importance and how they manifest in practice. Furthermore, open-ended responses illuminate potential causal relationships among factors as expressed by respondents themselves.

Chapter 6 – Transdisciplinary Engagement and Societal Interaction.

This chapter extends beyond the purely academic realm to encompass society and practice through experimentation with the elements of transdisciplinary inquiry. It describes a series of activities that engaged with the societal realm: continuous communication with practitioners through a long-term immersive internship (*Musha-shugyō*), facilitation of dialogues through organization of an international multi-stakeholder forum (*Project-Based Research*), as well as public

outreach and educational initiatives. These activities enabled feedback, mutual learning, and the co-production of knowledge, thereby bridging scientific analysis and real-world experiences. Reflecting on these experiences, this chapter also includes the author's self-reflexive contemplation on how the transdisciplinary theory can be operationalized in graduate research settings.

Chapter 7 – Final Synthesis: The Integrated Heuristic of Local Climate Governance.

The final chapter begins by comparing the outcomes of the empirical survey with those of a few analogous survey-based explorations on related topics in the existing literature. It further notes that the existing literature lacks an integrated, system-level understanding of the dynamic interplay among factors. Hence, the dissertation culminates in integrating all strands of evidence—existing knowledge, quantitative and qualitative findings, and transdisciplinary insights—into a holistic framework that illuminates this interplay. The resulting Integrated Heuristic Model of Local Climate Governance (IHMLCG) is a conceptual model, derived inductively from empirical evidence, that unites motivations, barriers, and enablers within a single structure and illuminates their interactions. The heuristic offers both a theoretical contribution—a systemic view of MBEs of local climate governance—and a practical tool for diagnosing challenges and identifying strategic pathways and leverage points for action. The chapter concludes the dissertation by summarizing its practical and theoretical contributions, acknowledging limitations, and outlining avenues for future research.

In summary, the dissertation follows a logical and cumulative structure:

Chapter 2 reviews literature and develops the analytical framework to guide the study.

Chapter 3 details the empirical research design (survey method).

Chapter 4 identifies what factors matter most to the majority of municipalities through descriptive statistics of numeric responses and explores their correlations.

Chapter 5 explains why these MBEs matter by uncovering collective interpretations through thematic analysis of qualitative responses.

Chapter 6 bridges the academic inquiry with societal engagement.

Chapter 7 revisits findings in relation to the literature and proceeds to integrate all strands of evidence into a unified dynamic conceptual model before making concluding remarks.

Together, these chapters form a continuous narrative—from mapping the field, to empirically illuminating it, to a synthesis of a usable and actionable framework. By combining analytical rigor, empirical breadth, interpretive depth, and societal engagement, the dissertation seeks to contribute not only to academic understanding but also to practical progress toward more coherent, effective, and motivated pathways to net-zero cities.

Chapter 2. An Integrated Analytical Framework

2.1 Building the Analytical Framework Through Extensive Literature Review

To operationalize the survey (described in Chapter 3), I first developed an integrated analytical framework of motivations, barriers, and enablers (MBEs) of urban climate action based on an extensive review of the existing literature. The literature selection followed an iterative snowballing strategy, whereby an initial set of seminal and review-based publications was identified and subsequently expanded by tracing relevant references cited within these sources. This process was repeated iteratively until additional sources no longer yielded substantively new MBE items.

From a methodological standpoint, this review does not constitute a fully systematic literature review in the strict sense (e.g., based on predefined database search strings and formal inclusion–exclusion protocols). Instead, it is best characterized as a structured, integrative review with a clear analytical purpose. This approach was chosen deliberately. Research on local climate governance and urban climate action is highly fragmented across disciplines and terminologies, making rigid systematic search strategies prone to either excessive exclusion or unmanageable breadth. A snowballing-based integrative review was therefore considered more suitable for identifying recurrently emphasized and conceptually salient MBE factors across diverse strands of literature, while maintaining transparency and analytical coherence.

The scope of the review was intentionally delimited. Priority was given to studies focusing on subnational governance, particularly municipalities and local governments, as the primary actors of interest in this dissertation. Studies centered on national governments or on other actor groups (e.g., firms, households, or individual behavioral change) were excluded unless they provided direct insights into municipal climate governance. Although the reviewed literature originates from multiple disciplinary fields—including urban studies, political science, public administration, and sustainability transitions—the unifying selection criterion was relevance to municipal decision-making and local climate action.

Within this corpus, particular attention was paid to studies that synthesize multiple motivations, barriers, or enabling conditions at a higher level of abstraction. These included literature reviews (D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019), major report chapters on urban climate governance (Bulkeley et al., 2009; Romero-Lankao et al., 2018), and selected survey-based studies of local governments (Aylett, 2014; Krause, 2013). The MBE items identified in these sources formed the initial backbone of the analytical framework. Subsequently, a wider body of complementary studies was reviewed to refine, adjust, and triangulate this core set of factors—by confirming their recurrence across contexts, clarifying conceptual boundaries, and, where necessary, modifying or expanding specific items. This two-step process ensured that the

resulting framework was both grounded in well-established syntheses and informed by broader empirical and conceptual insights from the literature.

This integrated framework directly informed the survey design presented in Chapter 3, where each synthesized MBE item was translated into corresponding survey items to enable empirical prioritization and assessment by municipal officials. While the review aimed to be comprehensive in terms of conceptual coverage, it does not claim exhaustiveness; its primary function was to support the construction of an analytically robust and empirically operationalizable survey instrument.

2.2 Motivations: Conceptual Foundations and Literature Synthesis

This study shifts attention from the structural determinants of municipalities' net-zero commitments to the motivations that sustain and orient their continued engagement with climate objectives. Previous research has examined how cities' objective factors—such as economic capacity, political context, regulatory mandates, or intergovernmental influence—influence the diffusion and formulation of their climate commitments and policies (e.g., Nakazawa et al., 2023; Reckien et al., 2015). Such approaches help explain *whether* and *under what conditions* commitments are likely to emerge. The present inquiry addresses a different question: *what actually moves* municipal actors to pursue and maintain these commitments once adopted.

Drawing on the classic and foundational work of Ryan and Deci (2000), to be motivated is “to be moved to do something.” Motivation thus refers to the underlying goals and values that energize and direct action—the “why” behind behavior. Understanding municipal climate governance from this perspective requires distinguishing motivations from determinants of action or non-action. Determinants refer to objective structural characteristics—such as population size, fiscal capacity, industrial composition, geographic context, or regulatory mandates—that may statistically correlate with policy adoption. In determinant-based research, such characteristics are treated as explanatory variables used to test associations between structural conditions and the likelihood of particular outcomes. Motivations, by contrast, are articulated by actors themselves. They reflect how municipal officials interpret their institutional environment and define what compels them to act. Studying motivations therefore entails examining the “why” of behavior directly rather than inferring it from structural proxies.

Within Self-Determination Theory (SDT), Ryan and Deci conceptualize motivation as existing along a continuum from externally regulated behavior to intrinsic motivation. At one end are actions driven purely by external pressures, such as compliance with mandates. At the other end are intrinsically motivated actions undertaken because they are experienced as meaningful or aligned with one's values. Between these poles lie intermediate forms in which externally introduced goals are internalized—that is, accepted as legitimate and worthwhile rather than merely

imposed (R. M. Ryan & Deci, 2000). This distinction is particularly relevant in the context of local climate governance, where engagement may range from compliance-driven responses to internally endorsed commitments grounded in perceived public value.

The focus of this study is on motivations that contain an intrinsic or internalized component. Purely external regulation—acting solely to comply with binding mandates—is conceptually closer to determinant-based explanations and therefore lies outside the primary scope of this inquiry. This emphasis is especially pertinent given the largely voluntary character of local net-zero commitments. In many cases, municipalities adopt climate targets without strict legal obligation. Their engagement thus appears shaped not only by external pressures but also by self-determined priorities and perceived co-benefits, including economic revitalization, public health improvements, enhanced resilience, civic identity, reputational gains, and contributions to global environmental responsibility (Anguelovski & Carmin, 2011; Bai, 2007; Bain et al., 2016; M. M. Betsill, 2001; Engel & Orbach, 2008; Lee & Koski, 2012; D. Ryan, 2015; Scanu & Cloutier, 2015).

Although SDT was originally developed at the level of individual psychology, its conceptualization of internalization provides a useful analytical lens for collective actors. In this study, I extend the framework to municipal administrations as institutional entities composed of officials exercising delegated authority on behalf of citizens. While municipalities do not possess motivations in a literal psychological sense, their policy orientations emerge through the interpretations and judgments of responsible officials. The motivations articulated by these officials are therefore treated as reflective of the municipality's institutional orientation.

This analytical move rests on the assumption that local officials act primarily in pursuit of perceived public goals. This contrasts with public choice theory (e.g., Buchanan & Tullock, 1962; Niskanen, 2017), which models public officials as self-interested utility maximizers. Instead, the present study adopts a governance-oriented perspective consistent with public administration and institutional theory that emphasizes role-based responsibility (March & Olsen, 2009), public service motivation (Denhardt & Denhardt, 2000), and collective action logic (Ostrom, 1990). Within this framework, expressed motivations are interpreted as institutional commitments to perceived public value rather than purely personal incentives.

This conceptual orientation guided the literature synthesis described in Section 2.1. Recurrent motivational themes were identified across studies and grouped according to their underlying orientation, such as economic development, well-being, identity, or global contribution. Factors reflecting purely compliance-driven behavior were treated as structural conditions that lacked the element of actors' agency and self-determination and were therefore excluded from the synthesized list. Through this process, nine major motivations were identified across six categories (Table 2.1), forming the conceptual basis for the empirical prioritization conducted in Chapter 3.

Table 2.1. Common intrinsic motivations of municipalities toward local climate action

Category	N	Motivations	Direct high-level overviews	Broader supporting literature
Local economic development	1.1	Cost savings and financial benefits: Achieving savings with more efficient equipment, boosting property value (e.g., via building retrofits, presence of green/blue infrastructure), revenue from specific policies (e.g., traffic tolls and congestion taxes), and other direct financial benefits	(Krause, 2013; Sippel & Jenssen, 2009)	(Aylett, 2015; Bai, 2007; M. M. Betsill, 2001; Bulkeley & Betsill, 2013; Bulkeley et al., 2009; CDP & ICLEI, 2021; Engel, 2006; Jones, 2017; Lee & Koski, 2012; Lwasa et al., 2022; Moore, 2012; OECD, 2009; Qi et al., 2008; Romero-Lankao et al., 2018; Steg et al., 2022; UN-Habitat, UNESCAP, 2018)
	1.2	Local industry development and economic revitalization (via green growth/circular economy): Enhancing the local economy's competitiveness with job creation, increased productivity, new investments, and attracting businesses and talent through the promotion of the innovative green economy sector.	(Aylett, 2014; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; Bulkeley, 2011; Bunsell et al., 2023; CDP & ICLEI, 2021; Coulombe et al., 2022; Engel, 2006; Engel & Orbach, 2008; Fuhr et al., 2018; Kuromizu, n.d.; Lwasa et al., 2022; Moore, 2012; OECD, 2009; Ruiz-Campillo et al., 2021; Steg et al., 2022; UN Climate Change High-Level Champions, 2022; UN-Habitat, UNESCAP, 2018; Zimmer et al., 2015)
	1.3	Improving local energy conditions: Developing local renewable energy to enhance self-sufficiency, independence, and stability of energy supply while reinvesting the energy revenues into the local economy and community (i.e., "local production, local consumption")	-	(Bulkeley, 2011; Bulkeley & Betsill, 2013; Bulkeley et al., 2009; De Gregorio Hurtado et al., 2015; Engel, 2006; Myasoedov & Ota, 2021; Ohta & Barrett, 2023; Qi et al., 2008; Steg et al., 2022; Zimmer et al., 2015)
Quality of Life	2	Enhancing residents' well-being and health: Mitigating air pollution, traffic congestion, and urban heat islands through emission reductions, urban greening, sustainable transport, and other synergistic initiatives that improve public health and quality of life	(Aylett, 2014; Krause, 2013; Sippel & Jenssen, 2009)	(Bai, 2007; M. M. Betsill, 2001; Bulkeley, 2010; Bulkeley et al., 2009; CDP & ICLEI, 2021; Denton et al., 2022; Lwasa et al., 2022; Moore, 2012; OECD, 2009; Ruiz-Campillo et al., 2021; Seth et al., 2023; Steg et al., 2022; UN Climate Change High-Level Champions, 2022; UN-Habitat, 2022; UN-Habitat, UNESCAP, 2018)
Institutional	3	Strengthening ties and gaining assistance from the national government by engaging in pioneering nationally designated urban frameworks (e.g., Eco City, Smart City) or other pilot programs for low-carbon development	(Aylett, 2014; Krause, 2013)	(Mendizabal et al., 2021; Ohta & Barrett, 2023; Qi et al., 2008; Ruiz-Campillo et al., 2021; UN Climate Change High-Level Champions, 2022)
Political	4.1	Green city brand/identity: Cultivating an appealing city image (to attract new residents, entrepreneurs, tourists) and community pride in the city's environmental achievements, as well as securing other benefits from an enhanced reputation	(Aylett, 2014; Krause, 2013; Sippel & Jenssen, 2009)	(Engel, 2006; Engel & Orbach, 2008; Jones, 2017; Ruiz-Campillo et al., 2021; Wurzel et al., 2020)
	4.2	Trend-setting and elevating municipal leadership: Highlighting the local government's role in the global climate agenda to gain political capital, setting the trend for climate action at local, national, and international levels, and mobilizing stakeholders toward action	(Aylett, 2014; Krause, 2013; Sippel & Jenssen, 2009)	(Acuto, 2013; Bulkeley, 2010, 2011; Bulkeley et al., 2009; Coulombe et al., 2022; Engel, 2006; Engel & Orbach, 2008; Fuhr et al., 2018; Kern & Alber, 2009; Lwasa et al., 2022; Qi et al., 2008; Ruiz-Campillo et al., 2021; UN-Habitat, 2022)
Vulnerability	5	Ensuring safety and resilience: Perceiving vulnerability to climate impacts or having experienced past calamities and striving to safeguard residents and increase resilience (including future-proofing the energy system) through climate action	(Aylett, 2014; Krause, 2013; Sippel & Jenssen, 2009)	(OECD, 2009; Romero-Lankao, 2012; Ruiz-Campillo et al., 2021; UN-Habitat, UNESCAP, 2018; Zimmer et al., 2015)

Global norms, altruism	Aligning with global norms and contributing to global betterment: Inspired by 6 key international climate reports, conventions, and peers' best practice; driven by self-determined responsibility or altruism to contribute to global efforts	(Krause, 2013; Sippel & Jenssen, 2009)	(Bai, 2007; Bulkeley et al., 2009; Coulombe et al., 2022; Engel & Orbach, 2008; Jones, 2017; Okereke, 2007; Ruiz-Campillo et al., 2021)
------------------------	--	--	---

Source: Developed by the author based on the review and synthesis of relevant literature.

2.3 Barriers and Enablers: Conceptual Foundations and Synthesis

Climate mitigation and adaptation literature provides helpful theoretical clarifications of the concepts of "barriers" and "enablers." Although numerous aspects can hamper local climate action, most scholars emphasize the social and institutional nature of barriers, predominantly arising from human decisions or actions (Biesbroek et al., 2013; Burch, 2010a, 2010b; Eisenack et al., 2014; Reckien et al., 2015; Rincón et al., 2021; Romero-Lankao et al., 2018, p. 590). Indeed, in contrast to "limits" (typically of physical and ecological nature), barriers are viewed as not insurmountable—they can be overcome through concerted effort, effective management, prioritization, and political will (Biesbroek et al., 2013; Eisenack et al., 2014; Klein et al., 2014; Moser & Ekstrom, 2010; Reckien et al., 2015; Romero-Lankao et al., 2018, p. 590).

Additionally, the concept of "barriers" closely complements and interrelates with "enablers" (also called "drivers" or "enabling conditions")—factors that are conducive to climate action, facilitating and supporting it (van der Heijden, 2019). Scholars often view both notions as closely related, such as being opposites or mirror images, in concept (yet without implying strict analytical symmetry) (Biesbroek et al., 2013; Burch, 2010b; Klein et al., 2014; Reckien et al., 2015). For instance, Biesbroek et al. (2013) position barriers and enablers on a continuum as opposing notions, describing them as subjective perceptions by actors of factors exerting negative or positive influences on their climate efforts (Biesbroek et al., 2013). Accordingly, a certain condition or resource (e.g., competent personnel, technology, funding, or coordination among actors) can be perceived either as an enabler when sufficient or as a barrier when deficient (D. Ryan, 2015). Ideally, as some scholars put it, improving climate governance involves transforming barriers into enablers (Burch, 2010a, 2010b; Denton et al., 2022, p. 1764), for instance, when administrative silos were addressed, resulting in more effective cross-sector coordination.

To build a comprehensive analytical framework and minimize the omission of important factors, I adopted this dualistic lens in the literature review. Specifically, I mirrored items from both barrier-focused studies, and from enabler-focused ones, synthesizing insights on commonly identified factors from both literature streams. Consequently, I compiled two structured lists of common barriers (Table 2.2) and enablers (Table 2.3), each organized into four broad thematic categories. Beyond direct high-level (overview) literature on barriers and enablers, I also reviewed wider literature to triangulate and support the resulting synthesized items, enhancing the robustness of the framework.

Table 2.2. Common barriers hindering municipal efforts toward local climate action

Category	N	Barriers	Direct high-level overviews	Wider supporting literature
I. Municipal Capacity: Authority and Resources	1.1	Limited authority and influence of the dedicated municipal climate agency (or its parent bureau, e.g., environmental department)	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Aylett, 2015; Bulkeley, 2010; Burch, 2010a, 2010b; Kern & Alber, 2009)
	1.2	Limited municipal control over key policy areas and infrastructure that have strong GHG implications (e.g., energy, transport, utilities)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Aylett, 2015; Bai, 2007; M. M. Betsill, 2001; Bulkeley, 2010; Burch, 2010a, 2010b; CDP & ICLEI, 2021; Fuhr et al., 2018; Jones, 2017; Seth et al., 2023; UN-Habitat, 2022; van der Heijden, 2021)
	1.3	Inadequate (or lacking) legal and regulatory frameworks (e.g., laws, financing schemes, planning frameworks, and other provisions) conducive to local climate policies	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Bulkeley, 2011; Burch, 2010a, 2010b; CDP & ICLEI, 2021; Kern & Alber, 2009; Lee & Koski, 2012; Romero-Lankao, 2012)
	1.4	Constrained municipal budgets (i.e., limited own revenue or national transfers, fiscal stress)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; Bulkeley & Betsill, 2013; Burch, 2010a; Dubash et al., 2022; Jones, 2017; Kern & Alber, 2009; Kuromizu, n.d.; Lwasa et al., 2022; Reckien et al., 2015; UN-Habitat, 2022; UN-Habitat, UNESCAP, 2018)
	1.5	Limited accessibility to funding from external sources (e.g., financial organizations, private foundations, national or international grants and subsidies)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Bai, 2007; Bulkeley, 2010, 2011; CDP & ICLEI, 2021; Jones, 2017; Lwasa et al., 2022; Romero-Lankao, 2012; Seth et al., 2023; UN-Habitat, 2022)
	1.6	High upfront costs of climate measures, coupled with long recovery times prior to yielding benefits and return on investment	(Romero-Lankao et al., 2018; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; Lwasa et al., 2022; Reckien et al., 2015)
	1.7	Lack of staff (or staff-time) dedicated to climate-related tasks within the local administration	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; Bulkeley, 2010; Burch, 2010a; UN-Habitat, UNESCAP, 2018)
	1.8	Lack of access to technological options and specialized workforce in the local area	(Aylett, 2014; Bulkeley et al., 2009)	(Burch, 2010b; CDP & ICLEI, 2021; Kuromizu, n.d.; Seth et al., 2023; Zimmer et al., 2015)
II. Municipal Capacity: Knowledge and Expertise	2.1	Lack of specialized knowledge and expertise among local administration staff and policymakers, hindering the development of appropriate policy measures	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; Bulkeley, 2010; Burch, 2010a; Denton et al., 2022; UN-Habitat, 2022; van der Heijden, 2021)
	2.2	Limited access to reliable, locally-relevant data, necessary for policymaking and climate action (e.g., data on GHG emissions or energy consumption by local industries, infrastructure, households, etc.)	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; Bulkeley, 2010; Jones, 2017; Lwasa et al., 2022; UN-Habitat, 2022)
	2.3	Lack of methods, tools, or best-practice portfolios for creating climate policy-relevant information and assessments (e.g., GHG inventories, energy scenarios) that support policymaking	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009)	(Burch, 2010a; De Gregorio Hurtado et al., 2015; Jones, 2017; Lwasa et al., 2022; UN-Habitat, 2022)

III. Institutional coherence and coordina- tion	3.1	Administrative work culture (i.e., municipal staff job descriptions, work practices, and routines) is overly rigid and conservative, leaving little space to take risks, try new ideas or depart from “normal”	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009)	(Aylett, 2015; M. M. Betsill, 2001; Bulkeley, 2011; Burch, 2010a, 2010b; Conklin et al., 2007; Denton et al., 2022; Domorenok et al., 2021; Jones, 2017; UN-Habitat, 2022)
	3.2	Insufficient or fragmented collaboration and coordination on climate policy among local administration’s departments (e.g., environmental, urban planning, economic development, etc.)	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; Aylett, 2015; Bulkeley, 2010, 2011; Burch, 2010a, 2010b; Conklin et al., 2007; Denton et al., 2022; Domorenok et al., 2021; Jones, 2017; Lwasa et al., 2022; UN-Habitat, UNESCAP, 2018; van der Heijden, 2021)
	3.3	Limited inter-municipal cooperation and coordination of climate response with neighboring local authorities and other peer municipalities	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009)	(M. M. Betsill, 2001; CDP & ICLEI, 2021; UN-Habitat, 2022)
	3.4	Insufficient or inefficient vertical coordination and cooperation on climate policy between national, regional, and local authorities	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; Bulkeley, 2010, 2011; Burch, 2010a, 2010b; CDP & ICLEI, 2021; Denton et al., 2022; Dubash et al., 2022; Fuhr et al., 2018; Kern & Alber, 2009; Moore, 2012; UN-Habitat, 2022; UN-Habitat, UNESCAP, 2018; van der Heijden, 2021; van der Heijden et al., 2019)
	3.5	Difficulty in engaging and forming partnerships with local stakeholders (e.g., private sector, civil society) for co-creation and joint implementation of initiatives	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; Aylett, 2010, 2015; CDP & ICLEI, 2021; Denton et al., 2022; Jones, 2017; Lwasa et al., 2022; Sippel et al., 2022; UN-Habitat, 2022; United Nations Department of Economic and Social Affairs (UN DESA), 2023; van der Heijden, 2021)
IV. Political Will and Leader- ship	4.1	Lack of climate policy champions, i.e., individuals who promote, advocate, and lend political support to climate action (e.g., mayors, senior managers)	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; Bulkeley, 2011; Burch, 2010a; CDP & ICLEI, 2021; Domorenok et al., 2021; Jones, 2017; Lee & Koski, 2012)
	4.2	Lack of clear vision, guidance, and leadership by the upper echelons of government (i.e., inadequate high-level political context)	(Aylett, 2014; Bulkeley et al., 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; CDP & ICLEI, 2021; De Gregorio Hurtado et al., 2015; Domorenok et al., 2021; Lee & Koski, 2012; UN-Habitat, 2022)
	4.3	Low continuity and priority of climate action on municipal agenda (due to many competing issues and incognizance of synergies, politician term limits, inability to frame climate as an issue of local importance)	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009)	(Bai, 2007; M. Betsill & Bulkeley, 2007; M. M. Betsill, 2001; Bulkeley, 2011; Burch, 2010a, 2010b; Denton et al., 2022; Domorenok et al., 2021; Jones, 2017; Kern & Alber, 2009; Romero-Lankao, 2012; UN-Habitat, 2022)
	4.4	Low public interest, involvement, and demand for climate policy	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009)	(Bai, 2007; Burch, 2010b; Jones, 2017)
	4.5	Weak problem perception or skepticism among civil servants within the city hall	(Aylett, 2014; Sippel & Jenssen, 2009)	(Bai, 2007; M. M. Betsill, 2001; Burch, 2010a; Denton et al., 2022; Qi et al., 2008)

Source: Developed by the author based on the review and synthesis of the literature.

Table 2.3. Common enablers enhancing municipal efforts toward local climate action

Category	N	Enablers	Direct high-level overviews	Wider supporting literature
I. Municipal Capacity: Authority and Resources	1.1	Sufficient authority and influence of the dedicated climate agency (or its parent bureau, e.g., environmental department)	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Aylett, 2015; Burch, 2010a; Kern & Alber, 2009)
	1.2	Sufficient municipal autonomy and jurisdiction over key urban policy areas and infrastructure that have strong GHG implications (e.g., energy, transport, utilities)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Bai, 2007; M. M. Betsill, 2001; Bulkeley, 2010; CDP & ICLEI, 2021; Dubash et al., 2022; Jones, 2017; Romero-Lankao, 2012)
	1.3	Supportive legal context with adequate frameworks and mandates (e.g., laws, regulations, overarching policies) in place	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; Bulkeley, 2011; Bunsell et al., 2023; Burch, 2010a; CDP & ICLEI, 2021; Denton et al., 2022; Engel, 2006; Fuhr et al., 2018; Lee & Koski, 2012; Romero-Lankao, 2012; UN-Habitat, 2020; UN-Habitat, UNESCAP, 2018; United Nations, 2017; United Nations Department of Economic and Social Affairs (UN DESA), 2023; van der Heijden et al., 2019)
	1.4	Adequate municipal budget	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Anguelovski & Carmin, 2011; Bulkeley, 2011; CDP & ICLEI, 2021; Dubash et al., 2022; Jones, 2017; Lwasa et al., 2022; Salon et al., 2014; Seth et al., 2023; UN-Habitat, UNESCAP, 2018)
	1.5	Accessibility to funding from external sources (e.g., financial organizations, private foundations, national subsidies)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Bulkeley, 2011; CDP & ICLEI, 2021; Lwasa et al., 2022; Romero-Lankao, 2012; Seth et al., 2023; The Global Taskforce of Local and Regional Governments, UCLG, 2021; UN-Habitat, 2020, 2022)
	1.6	Realizable benefits, complementarities and linkages with other goals (e.g., SDGs) are well explored and exploited, thereby justifying and partially offsetting policy costs	(Aylett, 2014; Sippel & Jenssen, 2009)	(Bulkeley, 2010; Denton et al., 2022; Dubash et al., 2022; Jones, 2017; Lwasa et al., 2022; Moore, 2012; OECD, 2009; Steg et al., 2022)
	1.7	Enough staff dedicated to climate-related tasks within the local administration	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009)	(Bulkeley, 2010; Burch, 2010a)
	1.8	Local presence or access to low-carbon industry solutions (i.e., specialized technology and workforce)	(Aylett, 2014; Bulkeley et al., 2009)	(Burch, 2010b; Seth et al., 2023)
II. Municipal Capacity:	2.1	Adequate climate governance expertise among local administration staff and policymakers to identify locally suitable policy options and synergies	(Aylett, 2014; Bulkeley et al., 2009; Sippel & Jenssen, 2009)	(Burch, 2010a; Fuhr et al., 2018; Jones, 2017; Mendizabal et al., 2021; Seth et al., 2023)

Knowledge and Expertise	2.2	Access to reliable and locally relevant data (e.g., GHG emissions or energy consumption data) from various sources, including public and private organizations (e.g., regional utilities, local industries)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009)	(CDP & ICLEI, 2021; Mendizabal et al., 2021; UN-Habitat, 2022)
	2.3	Having access to technical instruments (e.g., tools, methods, and know-how) for generating policy-relevant information and assessments (e.g., carbon emissions inventory, energy scenarios) that support policymaking, including by being a member of domestically- or internationally-driven capacity-building initiatives	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(M. Betsill & Bulkeley, 2007; De Gregorio Hurtado et al., 2015; Jones, 2017; Lwasa et al., 2022; Romero-Lankao, 2012; Seth et al., 2023)
III. Institutional coherence and coordination	3.1	Municipal staff are stimulated, empowered, and actively encouraged to engage in climate work (through trainings and discussion groups, green accomplishment rewards, etc.); i.e., climate as part of the organizational culture	(Aylett, 2014; Bulkeley et al., 2009; Sippel & Jenssen, 2009)	(Aylett, 2010; Burch, 2010a; Conklin et al., 2007; Domorenok et al., 2021; Jones, 2017)
	3.2	Effective cross-sectoral coordination and cooperation on climate policy among local administration agencies (supported by mechanisms like an umbrella coordinating unit, working groups, designated coordinators, etc.)	(Bulkeley et al., 2009; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Aylett, 2015; M. M. Betsill, 2001; Bulkeley, 2010; Burch, 2010a; Denton et al., 2022; Domorenok et al., 2021; Jones, 2017; Kern & Alber, 2009; Kuromizu, n.d.; Lwasa et al., 2022; OECD, 2009; UN-Habitat, UNESCAP, 2018) (Bunsell et al., 2023; CDP & ICLEI, 2021; De Gregorio Hurtado et al., 2015; Fuhr et al., 2018; Jones, 2017; Kern & Alber, 2009; Lwasa et al., 2022; OECD, 2009; Reckien et al., 2015; Seth et al., 2023; UN-Habitat, 2022)
	3.3	Strong external horizontal cooperation and partnership for climate action with neighboring and other peer municipalities, including active membership in domestic or transnational city networks	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009)	(Bulkeley, 2011; CDP & ICLEI, 2021; Fuhr et al., 2018; Kern & Alber, 2009; Lwasa et al., 2022; OECD, 2009; Reckien et al., 2015; Salon et al., 2014; UN-Habitat, 2022; UN-Habitat, UNESCAP, 2018; United Nations, 2017; United Nations Department of Economic and Social Affairs (UN DESA), 2023; van der Heijden et al., 2019)
	3.4	Strong vertical alignment, strategic cooperation, and coordination of climate policy between national, regional, and local authorities	(Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)	(Aylett, 2010, 2015; Bunsell et al., 2023; CDP & ICLEI, 2021; Domorenok et al., 2021; Dubash et al., 2022; Göpfert et al., 2019; International Labour Organization (ILO), 2015; Jones, 2017; Lwasa et al., 2022; Mendizabal et al., 2021; OECD, 2009; Seth et al., 2023; Sippel et al., 2022; UN-Habitat, 2022; UN-Habitat, UNESCAP, 2018; United Nations Department of
	3.5	Sufficient partnerships and involvement of stakeholders (e.g., businesses, residents) in the creation and coordination of local climate initiatives	(Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019)	

		Economic and Social Affairs (UN DESA), 2023; van der Heijden, 2021)	
IV. Political Will and Leader- ship*	4.1	Presence of dedicated climate policy champions among local leaders (e.g., mayors, village chiefs), strongly advocating and steering local climate efforts	(Aylett, 2014; Bulkeley et al., 2009; Romero-Lankao et al., 2018; D. Ryan, 2015; Sippel & Jenssen, 2009; van der Heijden, 2019)
	4.2	Strong vision, enthusiasm and leadership by the upper echelons of government (national, provincial) and the major political party, advocating carbon neutrality on a sustained high-level policy agenda	(Bulkeley et al., 2009; D. Ryan, 2015; van der Heijden, 2019)
	4.3	High priority, continuity, and favorability toward environmental action on local agenda (e.g., city history of environmental action/struggle, consecutive re-elections of pro-environment mayors/politicians, forward-looking local declarations/commitments and political vision, climate successfully framed as “local” issue synergistic with local priorities)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015; Sippel & Jenssen, 2009)
	4.4	Citizens exhibiting high interest and demand for climate policy (e.g., high public climate awareness, civic pride of living in a “green city,” active pro-environment civil society organizations)	(Aylett, 2014; Bulkeley et al., 2009; D. Ryan, 2015)

* The mirror image of the barrier N4.5 as a corresponding enabler is omitted because the author deemed it inappropriate to pose to local officials in the survey. While a lack of awareness among government officials can be easily perceived as a barrier by observing skepticism and a lack of enthusiasm for climate policy in the local administration, the presence of awareness as an enabling condition is difficult to evaluate objectively.

Source: Developed by the author based on the review and synthesis of the literature.

Although I use the conceptual pairwise (mirror) relationship between barriers and enablers in the initial literature synthesis, I keep them independent in the rest of the research for the following methodological and analytical reasons. First, separate treatment provides clearer cognitive framing for survey respondents, enabling them to more precisely (and with less mental effort) evaluate each factor's salience (i.e., how severely a barrier impedes action and how significantly an enabler facilitates it). Second, it avoids the problematic assumption of symmetry between barrier–enabler pairs, as factors may exert asymmetric influences (Reckien et al., 2015). For example, high public awareness might strongly facilitate climate action, whereas limited awareness might not equally impede it, or vice versa. Relatedly, independent evaluation provides diagnostic insights: if a particular barrier and its corresponding enabler both rank highly, this suggests that addressing that barrier could significantly unlock its enabling potential. Conversely, if top-ranked barriers differ significantly from top-ranked enablers, this may demonstrate that certain factors predominantly impede action without their opposites necessarily serving as strong facilitators. Finally—and crucially for the integrated depiction of motivations, barriers, and enablers (see next Section 2.4)—I prepare the ground for exploring all MBE factors in terms of their relationships and their potential to reinforce one another. As an initial step toward this objective (and to empirically test the symmetry/asymmetry between barrier–enabler pairs), I conduct a correlation analysis of the survey response data (see Section 4.2.4).

2.4 Conceptual Interrelations and Integrated Depiction of MBEs

In addition to the intricate relationship between barriers and enablers, it is important to recognize both the connection and distinction between enablers and motivations. Even highly motivated actors may lack the necessary enabling environment and capacity to overcome barriers and effectively implement climate measures. Conversely, even when enabling conditions and capacities are present, actors might still lack sufficient motivation to translate that existing potential into action (Burch, 2010a, 2010b; Domorenok et al., 2021; D. Ryan, 2015). Put simply, motivations and enablers are distinct yet related: both are necessary, but neither alone is sufficient for effective climate governance (D. Ryan, 2015; van der Heijden, 2019).

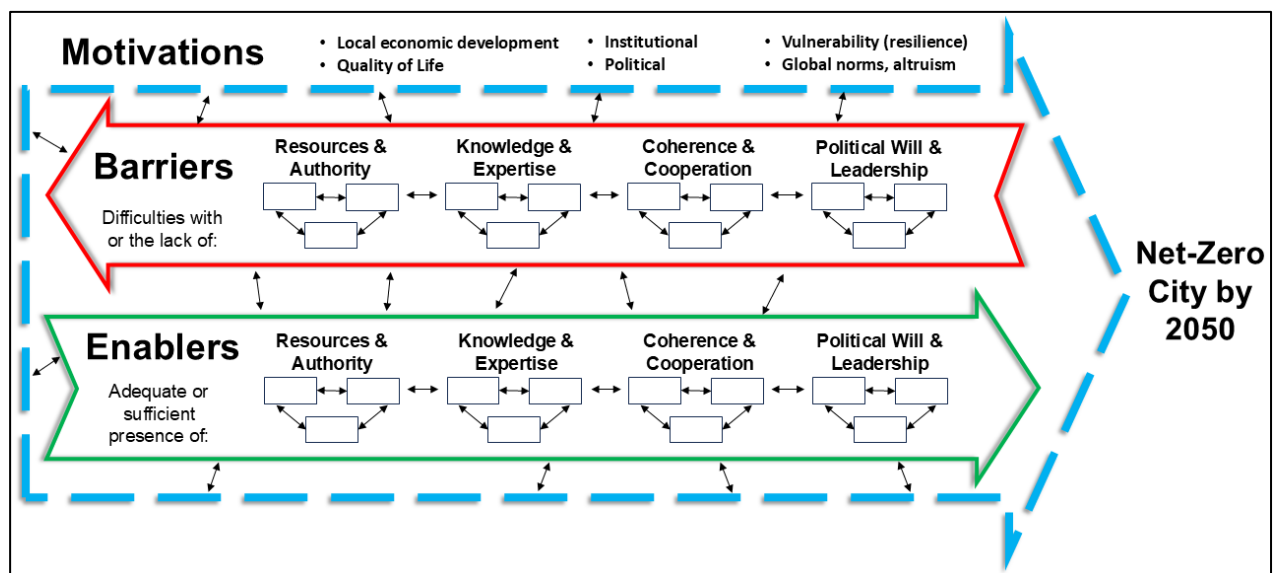
Crucially, motivations and enablers can mutually reinforce one another and help reduce barriers. For instance, compelling motivations that effectively demonstrate the rationale for local action (e.g., enhanced air quality) are attractive for local actors and, hence, can help secure dedicated budgets, garner citizen support, or enhance cross-sectoral collaboration—all important enabling factors. Similarly, key enablers—such as the presence of local climate champions or accessible financial support for local projects—can elevate the attractiveness of climate policies on the local agenda. By advocating for climate action and emphasizing relevant co-benefits, such

champions and supportive financial schemes can further motivate stakeholders and strengthen their commitment to act.

Thus, I present motivations, barriers, and enablers within a holistic, integrated framework that allows the independent analysis of each concept and factor, while acknowledging their inherent interrelatedness. Indeed, scholars increasingly emphasize that local climate responses are shaped by complex interactions among multiple factors (Eisenack et al., 2014; Romero-Lankao, 2012), stressing that climate governance cannot be effectively addressed through isolated perspectives (Bai, 2023; Biesbroek et al., 2013; Romero-Lankao et al., 2018, p. 589). By positioning the three MBE concepts and their respective key items (ranked through the survey) side-by-side within a holistic framework, I provide a basis for further exploration of their interrelationships, synergies, and trade-offs, which may inform the development of more effective local climate strategies.

In sum, the integrated framework can be conceptually depicted as shown in Figure 2.1.

Figure 2.1. Conceptual depiction of the integrated analytical framework, illustrating municipal motivations, barriers, and enablers (MBEs) toward net-zero emission cities



Note: Only broad categories are explicitly stated, with factors shown schematically as rectangles. See Tables 2.1–2.3 for the full list of specific MBE factors. Small, dual arrows indicate the interrelated nature of the MBE concepts and their factors, suggesting the presence of potential relationships (shown arbitrarily). Source: Author’s elaboration.

While the Integrated Analytical Framework organizes and systematizes the most recurrent motivations, barriers, and enablers identified in the literature, it remains primarily classificatory at this stage. Its purpose is to consolidate fragmented knowledge into a coherent analytical structure and to provide the conceptual foundation for empirical operationalization in the subsequent survey (Chapter 3-5). The relational and systemic development of these elements—explaining how they interact dynamically in practice—is undertaken later in the dissertation (Chapter 7).

Chapter 3. Survey Design and Implementation

To empirically assess which motivations, barriers, and enablers (MBEs) to achieving net-zero cities are perceived as most salient across a large number of municipalities, I employed a structured questionnaire survey. Survey methodology was selected to generate comparable data across diverse municipal contexts while allowing for both quantitative prioritization and qualitative elaboration.

3.1 Conceptual Basis and Survey Structure

The analytical framework developed in Chapter 2 directly informed the survey design. The MBE items synthesized from the literature (Tables 2.1–2.3) were presented to local officials through a structured questionnaire designed to identify which motivations, barriers, and enablers (MBEs) are perceived as most salient and why. Through the survey, salience was measured comprehensively—both quantitatively and qualitatively—and for each factor both individually and in relation to others.

In this research, I use the term “salience” to refer to the perceived prominence and significance of MBEs as experienced by municipal officials. As discussed in Chapter 2, motivations, barriers, and enablers are inherently socially constructed and actor-dependent phenomena; they arise from actor-specific interpretations of socio-institutional conditions (e.g., whether the municipality possesses sufficient administrative capacity, financial resources, technical expertise, and political support to advance net-zero policy) rather than from fixed structural attributes (e.g., population size, geographic location, or industrial profile). The concept of salience is therefore particularly appropriate, as it captures both the importance of a factor and the degree to which it stands out in the perception of the respondent within a specific municipal context.

To operationalize this concept in the survey instrument targeting Japanese municipalities, I employed two Japanese terms when posing questions to respondents. The term 重要 (jūyō), meaning “important; essential; significant; major; key; principal,” was used for motivations and enablers, whereas 重大 (jūdai), meaning “serious; important; significant; grave; weighty,” was used for barriers. Respondents were asked to evaluate the salience of each listed factor from the perspective of their administration.

The questionnaire was organized into nine thematic sections reflecting the analytical structure introduced in Chapter 2. The first section addressed municipalities’ motivations toward net-zero action. Sections two to five covered four categories of barriers (municipal capacity: authority and resources; municipal capacity: knowledge and expertise; institutional coherence and coordination; and political will and leadership). Sections six to nine mirrored this structure for enablers, again divided into four corresponding categories. Each of these nine sections followed an identical

three-stage question sequence, ensuring conceptual consistency while allowing respondents to reflect on each thematic cluster independently.

Within each section, the questionnaire consisted of three question stages. In the first (mandatory) stage, respondents rated the salience of each factor using a five-point unipolar Likert scale ranging from “1” (“of no significant importance”) to “5” (“very important”). Consequently, in the quantitative analysis presented in Chapter 4, I compute descriptive statistics (mean scores and standard deviations) based on the response frequencies for each item. Thus, items receiving mean scores above “4” indicate that they were frequently rated as “important” or “very important,” thereby signaling strong perceived salience across municipalities.

However, surveys measuring perceived importance are often subject to response bias, whereby respondents tend to rate most or all factors as important (Van Bennekom, 2017). To mitigate this potential inflation effect, each section included a second step following the Likert evaluation. After rating all items within a given category, respondents were asked to select the single most significant factor within that section. This forced prioritization required respondents to consider the items in relation to one another and identify the most salient one. In this way, the second stage complemented the Likert-scale ratings by revealing relative prominence among items and reducing the risk of uniformly high-importance responses.

Finally, in the third (optional) stage, respondents were invited to provide open-ended comments elaborating on their selections. This stage was deliberately positioned after the two structured quantitative steps. The questionnaire followed a gradual progression from cognitively less demanding tasks (rating each item individually) to more reflective comparison (selecting the single most significant factor within a section), and ultimately to the most demanding task—articulating, in their own words, why a particular factor was considered most salient in their municipal context.

This structured sequencing was intentional. By first asking respondents to evaluate each factor individually and then to prioritize one factor in relation to others, the survey design guided them through a process of structured reflection. As a result, when reaching the open-ended stage, respondents had already processed the full set of items and identified a focal issue. This progression increased the likelihood of substantive qualitative responses and yielded a rich corpus of contextualized explanations, which are analyzed in Chapter 5. The third stage thus enabled triangulation of the quantitative findings while capturing the reasoning and contextual specificity underlying municipal perceptions.

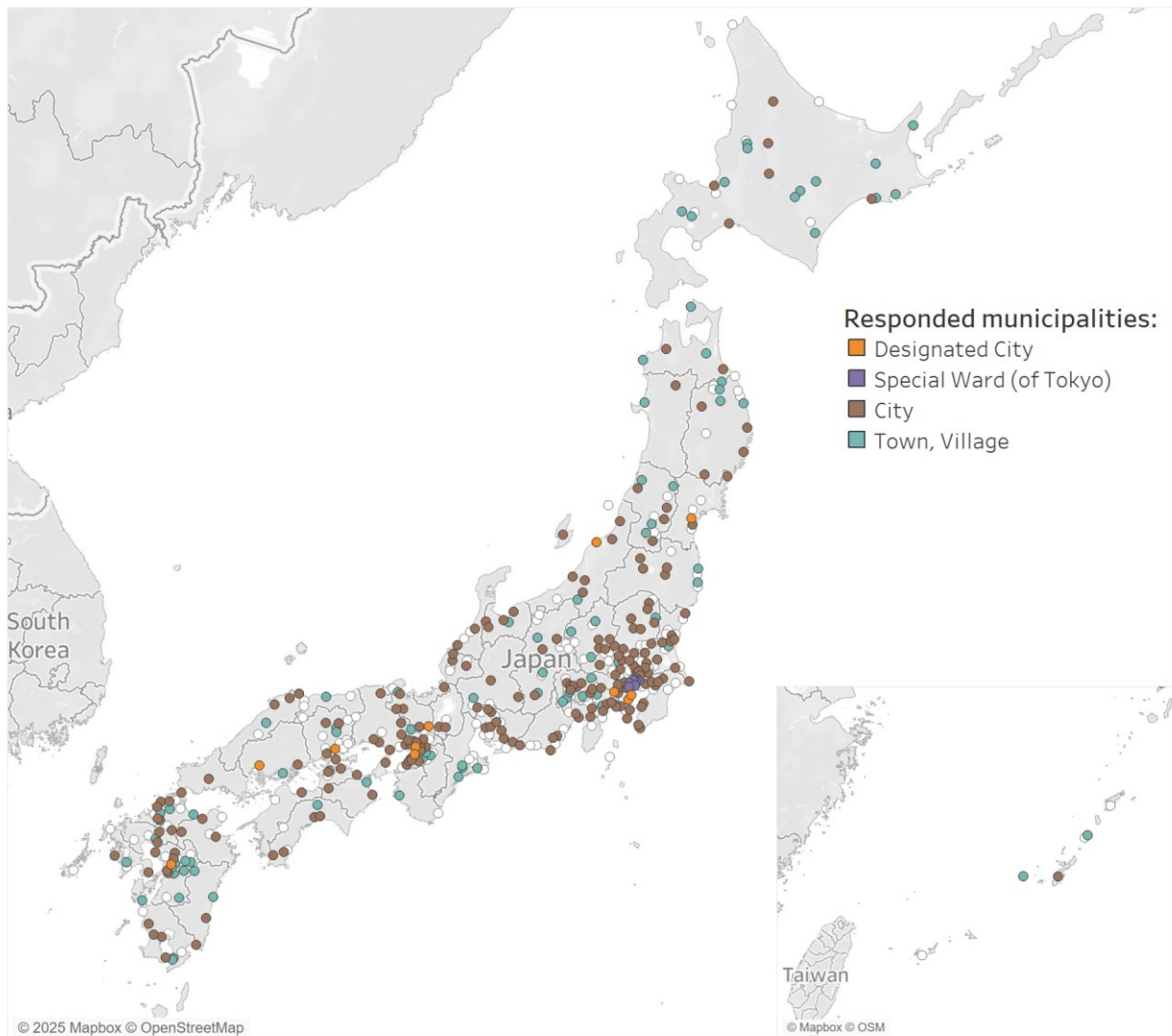
3.2 Target Population and Sampling Frame

The survey targeted all 489 municipalities in Japan with Zero Carbon Cities commitments as of January 2022 (Figure 3.1) and was conducted between June and August 2022. Although additional municipalities made declarations before the survey commenced, I maintained the initial

sample, considering that newly declared municipalities would require some time after their declarations in order to respond adequately.

While Zero Carbon City declarations in Japan include both prefectural and municipal governments (MOE, n.d.-c), I focus exclusively on municipalities (i.e., cities, towns, and villages), leaving prefectures outside the scope of this study.

Figure 3.1. Survey sample of 489 Zero Carbon Cities—Japanese municipalities committed to net-zero emissions (as of January 2022)



Note: Colored dots indicate the 309 responding municipalities (differentiated by administrative status); white dots represent non-respondents. Source: Author; visualization created using Tableau Desktop (version 2023.2.2).

I directed the survey to municipal officials formally responsible for net-zero policy within their administrations. In most cases, these officials were affiliated with environmental departments. However, depending on municipal size and administrative structure, responsibilities were

also located in planning and general policy divisions, citizen and community affairs departments, urban development and public works units, or industry and economic promotion bureaus (see respondents' profiles and affiliations in Section 3.5 and Appendix B). I therefore addressed the survey to the department officially designated as responsible for net-zero policy in each municipality.

I selected these officials because they are directly involved in the formulation, coordination, and implementation of local net-zero strategies. As such, they are expected to possess the most comprehensive and up-to-date knowledge regarding their municipality's climate policies and associated MBEs (Bai, 2007). Targeting these designated officers ensures that responses reflect informed institutional perspectives rather than peripheral viewpoints.

3.3 Questionnaire Validation, Endorsement, Positioning, and Ethics

After finalizing the questionnaire in English, I translated it into Japanese with the assistance of a native speaker. To ensure clarity and contextual appropriateness, I sought feedback from climate policy scholars at Kyoto University and Toyo University, as well as practitioners at the Institute for Global Environmental Strategies (IGES). I also pilot-tested the questionnaire with a municipal official from Kitakyushu City Hall, whose feedback helped refine wording and structure. The final version of the questionnaire (in Japanese) is provided in Appendix A.

To enhance institutional credibility and increase response rates, I included a formal request letter (お願い) as the first page of the survey package. The letter outlined the purpose of the study, its academic affiliation with Kyoto University, and its intended societal contribution. I attached an official letter of endorsement from my graduate school dean to provide additional authority. The request also included an ethical disclaimer clarifying voluntary participation, confidentiality of responses, and the absence of evaluative intent. Respondents were asked to confirm their agreement to participate prior to completing the questionnaire.

In the request letter, I emphasized the potential mutual benefit of participation. I informed municipalities that the findings would clarify the key motivations, barriers, and enabling conditions across Japan, thereby contributing to a better understanding of local climate governance and potential avenues for enhancing it. Framing the survey as a contribution to collective learning aimed to strengthen engagement and reduce perceptions of academic extraction.

Participation was entirely voluntary, and respondents were informed that they could decline or withdraw without consequence. No personal identifiers were collected beyond institutional affiliation, and responses were analyzed in aggregated form. The survey targeted public officials strictly in their professional capacity and did not seek personal, sensitive, or restricted information beyond statements made within the scope of their public administrative roles. As such, the study did not require formal review by the university ethics committee. The survey did not evaluate

individual or municipal performance but sought to understand general patterns of local climate governance.

3.4 Contact Strategy and Data Collection Protocol

Prior to implementation, I compiled contact information for all 489 municipalities by reviewing official websites and identifying the department responsible for Zero Carbon City declarations. Where necessary, I used official inquiry forms or contacted municipal call centers to confirm contact details.

I followed a structured multi-stage contact protocol. I individually addressed initial contact emails rather than distributing mass mailings. To avoid institutional spam filters, the first-contact message introduced the research and asked whether the municipality would be willing to receive the survey materials, without attaching files. Upon receiving consent, I sent the full survey package.

Recognizing that Japanese municipal offices operate under varying IT restrictions (e.g., limitations on opening external attachments or accessing external web links), I provided the survey in multiple formats: an online Google Form and an editable PDF file formatted for A4 printing. This duplication aimed to minimize technical barriers and accommodate different institutional digital environments.

I implemented a two-deadline system. As the initial deadline approached, I notified non-responding municipalities of a deadline extension, which functioned both as a reminder and as acknowledgment of administrative workload. I sent a final reminder prior to the extended deadline and conducted telephone follow-ups where appropriate. Throughout the process, I maintained a detailed contact database recording response status, dates of correspondence, and follow-up actions. Upon receiving responses or formal rejections, I sent gratitude emails to acknowledge participation.

Of the 489 targeted municipalities, 446 formally granted permission to distribute the survey.

3.5 Response Profile and Data Quality Considerations

I received responses from 309 municipalities (63% response rate), whose jurisdictions cover approximately 49 million people (about 44% of Japan's population). Response rates across administrative categories closely mirrored the overall distribution, each achieving around a 60% response rate (Table 3.1). As detailed in Chapter 4, the quantitative findings are presented both in aggregate form and with breakdowns by administrative category, allowing comparison across designated cities, special wards, cities, and towns/villages.

Table 3.1. Survey sample characteristics and response rates by administrative category

Administrative category	Total municipalities in Japan	Contacts (Zero Carbon Cities as of January 2022)	Responses (Response Rate, %)	Mean Population of Responded Jurisdictions
Designated City ¹	20	19	11 (58%)	1,421,257
Special wards (Tokyo) ²	23	15	10 (67%)	410,162
City	772	296	202 (68%)	141,090
Town, Village	926	159	86 (54%)	11,908
Total	1740	489	309 (63%)	159,416

Notes: ¹ Designated Cities are large municipalities (population $\geq 500,000$) with enhanced administrative autonomy granted by national ordinance. ² Special wards within the Tokyo Metropolis have administrative autonomy comparable to independent cities. Source: Author; Population Census 2020.

A response was considered valid if the mandatory first stage (Likert-scale evaluation of all MBE items) was completed. In the online version of the questionnaire, the system required completion of all Stage 1 items prior to submission. Although the PDF version did not technically enforce this constraint, all returned responses contained completed Stage 1 evaluations. Consequently, all 309 received responses were included in the quantitative analysis.

“I don’t know” responses were excluded from mean calculations in order to preserve the accuracy of salience estimates. The inclusion of a “Don’t know” option allowed respondents to refrain from evaluating factors about which they felt uncertain, thereby ensuring that computed means reflected only considered and confident assessments. Given the high overall response rate and the relatively small proportion of “Don’t know” selections, excluding these responses did not materially reduce the dataset but instead strengthened the validity of the findings by avoiding forced or speculative evaluations.

The optional prioritization (Stage 2) and free-text qualitative questions (Stage 3) allowed respondents to provide additional input at their discretion, thereby reducing response burden while preserving analytical depth. The prioritization stage (selecting the “single most significant” factor within each survey section) achieved near-complete participation, with responses typically ranging between 305 and 307 municipalities, depending on the section.

The optional open-ended stage yielded substantial qualitative material. Across the questionnaire sections, the number of open-ended responses ranged from 83 to 153, representing approximately 27% to 50% (of the 309) respondents who chose to provide textual elaborations. In total, across nine survey sections, this yielded a corpus of 991 qualitative entries (see the detailed breakdown in Table 5.1 in Chapter 5). The optional structure thus balanced flexibility with substantial qualitative engagement, preserving both statistical robustness and analytical depth.

Table 3.2 shows that almost half of the respondents were affiliated with environmental departments, while the remainder were located in planning, citizen affairs, urban development, industry, general affairs, or welfare units. This variation is closely linked to municipal population size.

Table 3.2. Distribution of respondents by department affiliation

Department Category	N of Respondents	Percentage of total	Mean Population
Environment Department (Environment / Climate / Decarbonization)	149	48%	279,809
Citizen and Community Affairs Department (Resident / Civic Affairs)	88	28%	56,839
Planning and General Policy Department	34	11%	22,946
Urban Development, Construction, Public Works, and Utilities Department	15	5%	51,491
Industry, Economy, and Commerce Department	10	3%	30,703
General Affairs Department (Administrative / Internal Management)	3	1%	13,762
Welfare and Social Services Department	2	1%	5,808
Not Specified	8	3%	81,725

Note: See Appendix B for the full list of all respondents and their details. Source: Author, based on survey response data and population census 2020.

In larger municipalities, net-zero responsibilities are typically assigned to dedicated environmental or climate-related departments. In smaller municipalities, such specialized units often do not exist. As a result, net-zero policy is placed within multifunctional administrative departments, most commonly planning and general policy divisions, citizen affairs departments, or general affairs units. The data, therefore, demonstrate that the institutional placement of net-zero responsibilities is largely structured by municipal scale.

Having established the survey design, data integrity, and respondent profile, this chapter has established the survey-based methodological foundation for the quantitative analysis presented in Chapter 4. Specifically, Chapter 4 applies descriptive statistical analysis to the Likert-scale and prioritization data generated through the survey instrument described above.

The subsequent chapters introduce additional methodological approaches tailored to their respective analytical objectives. Chapter 5 details the qualitative methodology used to analyze the open-ended responses, Chapter 6 explains the transdisciplinary research activities and participatory components of the study, and Chapter 7 presents the methodological logic underlying the integrative heuristic synthesis. Together, these chapters build upon the survey structure introduced here while employing distinct analytical frameworks appropriate to each stage of the inquiry.

Chapter 4. Key Motivations, Barriers, and Enablers toward Net-Zero Cities

4.1 Introduction

This chapter presents the quantitative results of the nationwide survey conducted among Japan's Zero Carbon Cities. Building on the analytical framework developed in Chapter 2 and the survey instrument described in Chapter 3, the analysis identifies which motivations, barriers, and enablers (MBEs) are perceived as most salient by municipal officials.

Methodologically, the chapter relies primarily on descriptive statistical analysis. For the mandatory first-stage responses, I calculate mean scores and standard deviations for each MBE item based on five-point Likert-scale evaluations, excluding "Don't know" responses (as explained in Chapter 3). These statistics provide an overview of the relative salience of each factor across the 309 responding municipalities. The results are presented in bar charts, both in aggregated form (across all municipalities; depicted as bars) and disaggregated by municipal type (designated cities, special wards, cities, towns, and villages; depicted as diamond markers), enabling comparison across administrative contexts.

In addition, pie charts present the response frequencies from the forced-prioritization stage, in which respondents selected the single most significant factor within each survey section. Finally, Spearman's rank correlation coefficients are used to explore associations among selected items, offering preliminary insight into how different factors may co-occur in municipal perceptions.

The chapter is structured as follows. It first presents the ranked motivations, followed by barriers and enablers across four categories (survey sections) each: (I) municipal capacity in terms of resources and authority; (II) municipal capacity in terms of knowledge and expertise; (III) organizational coherence and cooperation; and (IV) political will and leadership. Beyond reporting descriptive patterns, the chapter offers an extensive discussion that situates the findings within the broader literature and draws out their implications and applicability beyond Japan. The concluding section briefly reflects on limitations and summarizes the most salient MBEs in a single conceptual figure, thereby embedding the empirically ranked factors back into the integrated analytical framework developed in Chapter 2. This provides a consolidated bird's-eye view of key MBEs related within the broader conceptual scheme. In this way, Chapter 4 constitutes a substantial empirical contribution of this dissertation⁷.

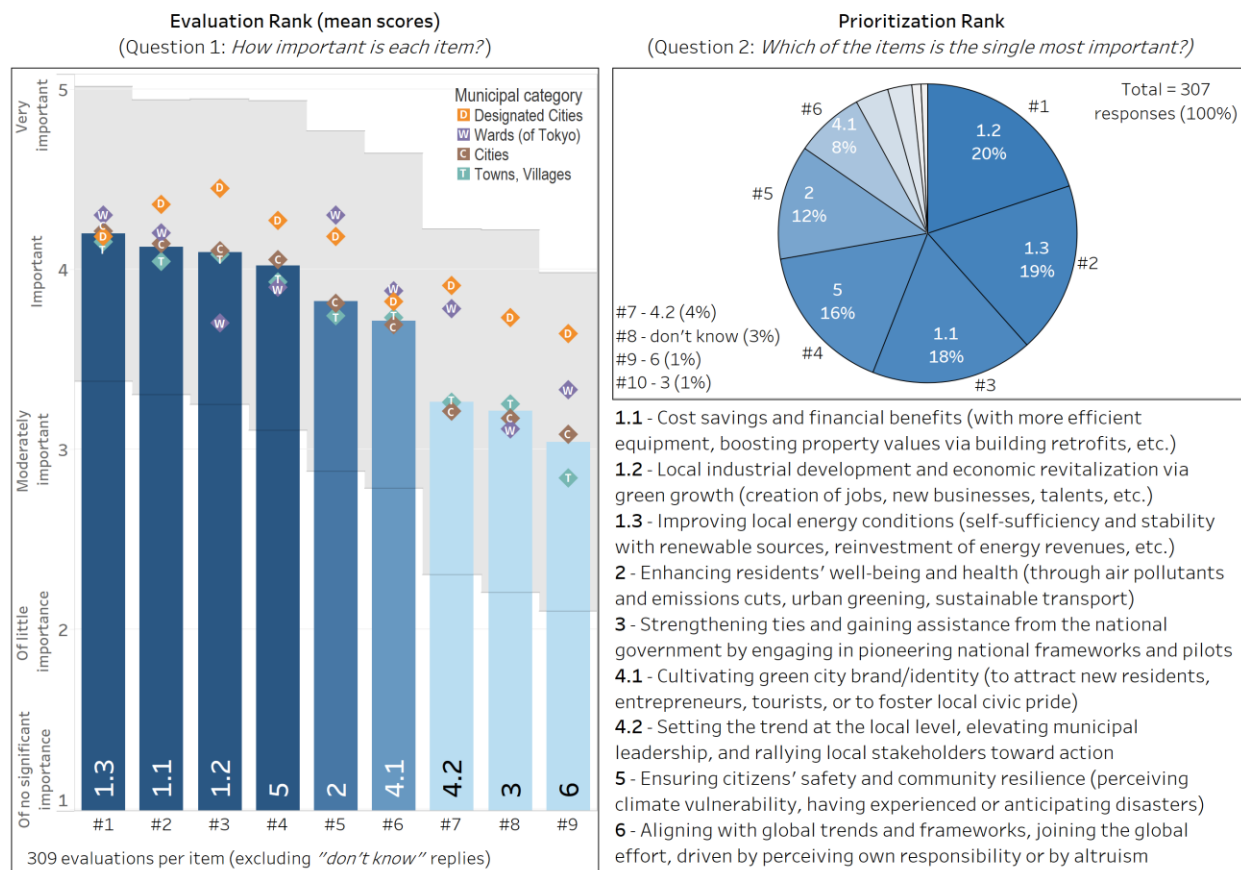
⁷ This chapter (together with elements of chapters 2 and 3) was also published as a stand-alone peer-reviewed publication: Myasoedov, F., & Ialnazov, D. S. (2025). Key Motivations, Barriers, and Enablers Toward Net-Zero Cities: An Integrated Framework and Large Survey in Japan. *Climate*, 13(7), 134.

4.2 Descriptive Statistical Analysis of the Quantitative Survey Response

4.2.1 Survey Results: Motivations

Among the common motivations identified in the existing literature (Table 2.1), the survey further elucidates those that were most frequently perceived as salient among Zero Carbon Cities (Figure 4.1).

Figure 4.1. Motivations toward achieving net-zero emissions by municipalities



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" motivation (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2)

The results indicate that key motivations center around the potential benefits to local economic development (M1.1, M1.2, M1.3). On average, municipalities tend to attach extremely high significance to these three economy-related items, which indicates the primary role of economic motivations for most respondents (see bar chart). When asked to prioritize, every fifth municipality (20%) identifies benefits to *local industry development and economic revitalization* (M1.2) as their top motivation. Similarly, 19% prioritize *improving local energy conditions* (M1.3), and 18%

emphasize *achieving cost savings and direct financial benefits* (M1.1) (see pie chart). Another prominent motivation is the municipalities' desire to *ensure safety and resilience* (M5) (i.e., perceiving vulnerability and striving to future-proof local infrastructure) through climate action, standing fourth in both evaluation and prioritization rankings.

Improving local energy conditions (M1.3), emerging as the top-ranking motivation, indicates that many municipalities recognize climate action as a clear opportunity to enhance local energy self-sufficiency. Municipalities believe that promoting local renewable energy enterprises not only increases the overall energy self-sufficiency of the municipality but also enables local authorities to reduce spending on energy imports and retain the revenues within the municipality. This strengthens local economic sustainability while contributing to the overall goal of achieving net-zero emissions. All municipalities evaluate this motivation equally highly, regardless of their administrative divisions. Similarly, *the direct financial benefits* (M1.1) motive (i.e., cost savings and added value from more efficient equipment and green buildings, etc.) consistently ranks highly among all municipality types.

More nuanced patterns are observed regarding *local economic growth and revitalization through developing the “green” industry sector* (M1.2). This motivation reflects municipalities' aspirations to reverse depopulation and economic stagnation by fostering green businesses, creating new jobs, attracting residents, and consequently enhancing local tax revenues and overall economic vitality. Notably, the revitalization motive is particularly salient among larger (designated) cities. This finding aligns well with Japan's socioeconomic context, where (except for Tokyo, Osaka, and a few other thriving urban centers) many large industrial legacy cities grapple with ongoing population decline and economic slowdown. Consequently, these large legacy cities actively seek new identities and growth pathways, including placing green industries at the center of their revitalization strategies.

Motivations such as *improvements in residents' well-being and health* (M2) and *gaining the “green city” reputation* (M4.1) are also significant on average among all responding municipalities, albeit slightly less than the economic and safety motives. As for the former (M2), municipalities strive to raise residents' overall quality of life by addressing air pollution, traffic congestion, and urban heat islands through urban greening, sustainable transportation, and other measures, with 12% citing this aspect as their foremost motivation. Notably, this motivation is especially significant for larger municipalities (designated cities and Tokyo wards). The latter motivation (M4.1) reflects municipalities' ambitions to gain recognition and a favorable reputation as sustainable, eco-friendly communities, and is prioritized by 8% of respondents, evenly distributed across administrative categories.

Other motivations appear less prominent. However, the motivation of cities for *setting the trend as champions of climate action* (M4.2) emerges as relatively important among populous

cities (designated cities and Tokyo wards), which is consistent with their higher responsibility and larger capacity for action. Lastly, in a rather notable outcome, the altruistic objective of *aligning with global norms and contributing to global betterment* (M6) closes the rank as the least salient motivation.

In summary, the results of the Motivations section of the survey show that in the pursuit of net-zero emissions, responding municipalities tend to be driven the most by economic and resilience motivations and, to a slightly lesser degree, by the opportunities to enhance residents' quality of life and to boost the city's brand and reputation.

4.2.2 Survey Results: Barriers

4.2.2.1 Category I: Municipal Capacity Constraints—Authority and Resources

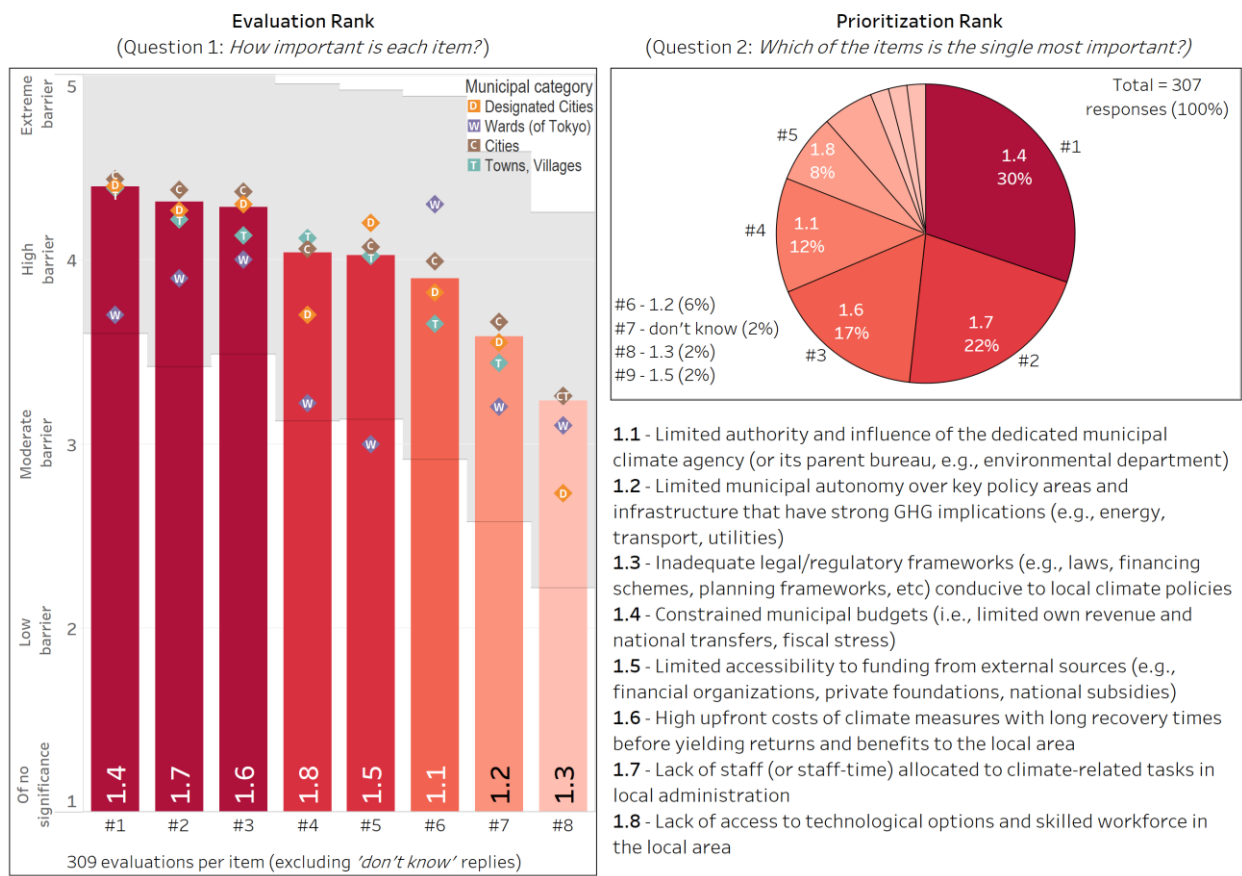
In the Barriers section of the survey, the first category encompasses barriers related to municipal capacity constraints in terms of authority and resources (Figure 4.2). The survey identifies *constrained municipal budgets* (B1.4), *lack of climate-dedicated staff* (B1.7), and *high upfront costs of climate initiatives* (B1.6) as the most significant barriers, receiving the highest average ratings (see bar chart). Likewise, when respondents were asked to select “the single most important” barrier, approximately two-thirds (69%) chose one of these three items (see pie chart), confirming their salience.

Constrained municipal budget (B1.4) emerges as the most significant barrier overall (mean score of 4.4), with nearly one-third of respondents (93 out of 307) selecting it as their primary constraint. Despite net-zero commitments, most municipalities struggle to allocate sufficient funds to net-zero initiatives alongside their existing public service responsibilities. This barrier is rated highly across all municipal categories, with the notable exception of Tokyo wards.

The lack of climate-dedicated staff (B1.7) is another prominent barrier, rated highly on average and prioritized by every fifth respondent. Although closely related to budget constraints, staffing presents a separate issue, representing another severe barrier to municipalities' climate actions. This barrier is consistently significant across all municipalities, albeit somewhat less acute in Tokyo wards.

The above results show that most local administrations are highly concerned about delivering progress toward net zero without adequate municipal budgets and staffing. Apart from dynamic urban areas such as most Tokyo wards, the prominence of these concerns underscores the broader context of ongoing demographic and economic stagnation faced by many local governments in Japan. Relatedly, *the high initial costs of climate action* (B1.6) constitute the third most significant barrier, rated consistently high by respondents across all municipal types.

Figure 4.2. Barriers to achieving net-zero emissions by municipalities (Category I: Municipal capacity constraints—resources and authority)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

Notably, staffing shortages are particularly acute within municipal administrations themselves. Although the broader *lack of specialized local workforce and technology* (B1.8) is regarded as a “high barrier,” it remains less critical than the internal *shortage of climate-dedicated municipal staff* (B1.7), which many rate as an “extreme barrier”. Understandably, medium-sized cities and towns find general *workforce and technology constraints* (B1.8) more pressing compared to larger and better-resourced municipalities such as designated cities and Tokyo wards.

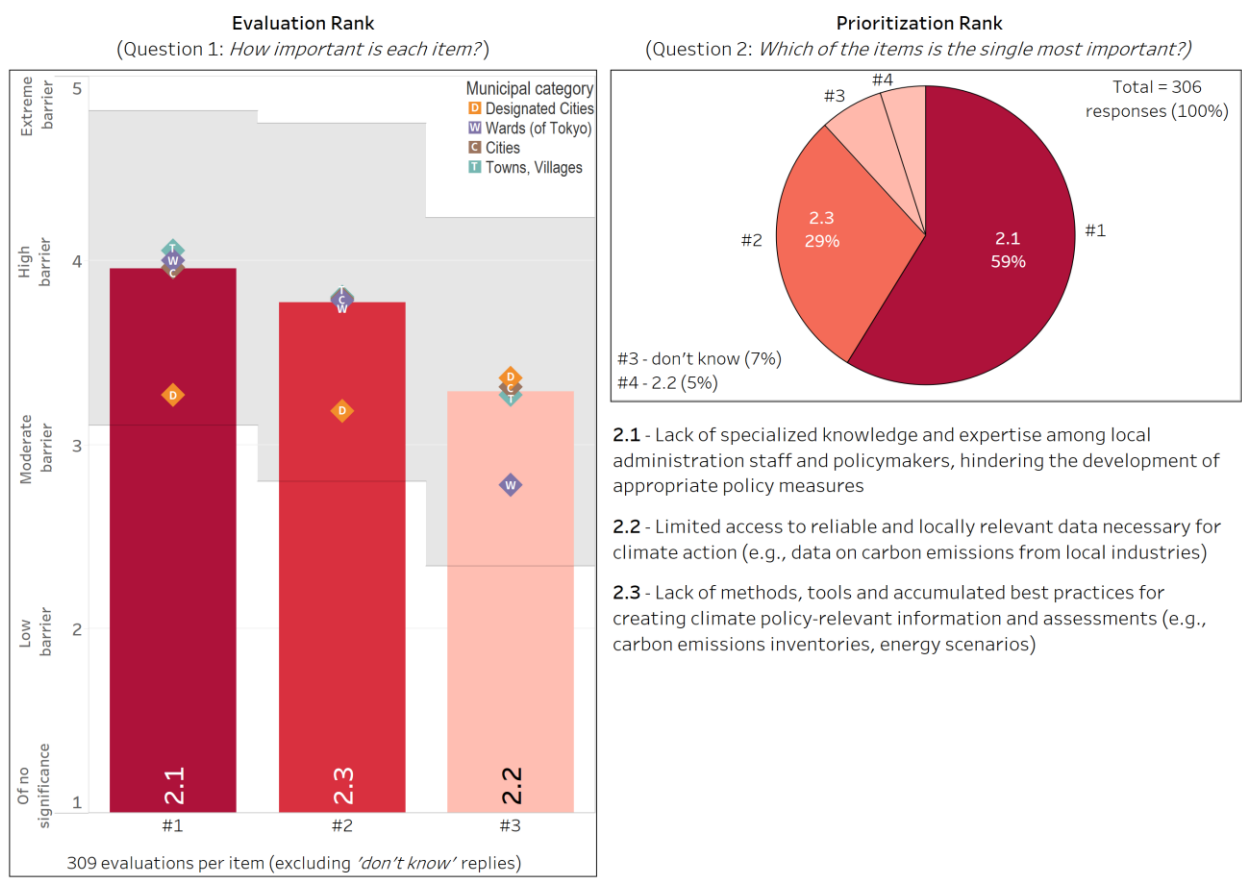
A common thread in the results is that resource-related constraints (B1.4-B1.8) clearly dominate municipalities’ concerns, whereas barriers related to authority and control (B1.1-B1.3) are perceived as less significant. Nevertheless, *the limited authority of climate agencies* (B1.1) remains prominent for 12% of respondents (38 out of 307). Particularly so in Tokyo wards, where

it is rated notably higher than resource-related concerns, which may suggest that the capital’s ward-level climate agencies face certain power imbalances vis-à-vis the metropolitan government.

4.2.2.2 Category II: Municipal Capacity Constraints—Knowledge and Expertise

Category II focuses on municipal capacity limitations regarding the knowledge and expertise needed to deliver on the net-zero commitment. Factors included here relate to insufficient specialized knowledge by the municipal staff, data gaps, and methodological shortages (Figure 4.3). Compared to Category I, barriers here receive slightly lower average ratings, generally between 3 (“moderate barrier”) and 4 (“high barrier”) (see bar chart).

Figure 4.3. Barriers to achieving net-zero emissions by municipalities (Category II: Municipal capacity constraints—knowledge and expertise)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

The lack of specialized knowledge and expertise among local administration staff and policymakers (B2.1) emerges as the most prominent barrier in this category, with an average score just below 4 (“high barrier”). Notably, over half (59%) of respondents identified this factor as the

single most critical barrier (see pie chart). This underscores a pervasive issue: many municipalities lack the specialized expertise needed to formulate and implement effective net-zero strategies.⁸ This challenge is likely compounded by staff shortages in local administrations, as also highlighted in my findings (see Section 4.2.2.1). Indeed, the emergence of climate-related tasks within the municipal administration's sphere of responsibility, together with a general lack of experience in climate policymaking and the steep learning curve, likely adds further burden on existing staff. Standing as the most severe, this barrier dwarfs the other two barriers related to managing relevant climate data necessary for policymaking (B2.2-B2.3).

The second most salient barrier identified relates to *inadequate technical instruments for handling climate data* (B2.3), including the absence of standardized methods, accessible tools, and best practices available to local officials. Many municipalities remain in the initial stages of formulating their net-zero strategies and face significant challenges in creating and managing datasets and systems with essential climate data, such as local GHG inventories. Municipalities require user-friendly tools, standardized methodologies, and practical guidelines to effectively manage data and perform essential assessments. Approximately 29% of respondents highlighted this factor as the most significant barrier within Category II.

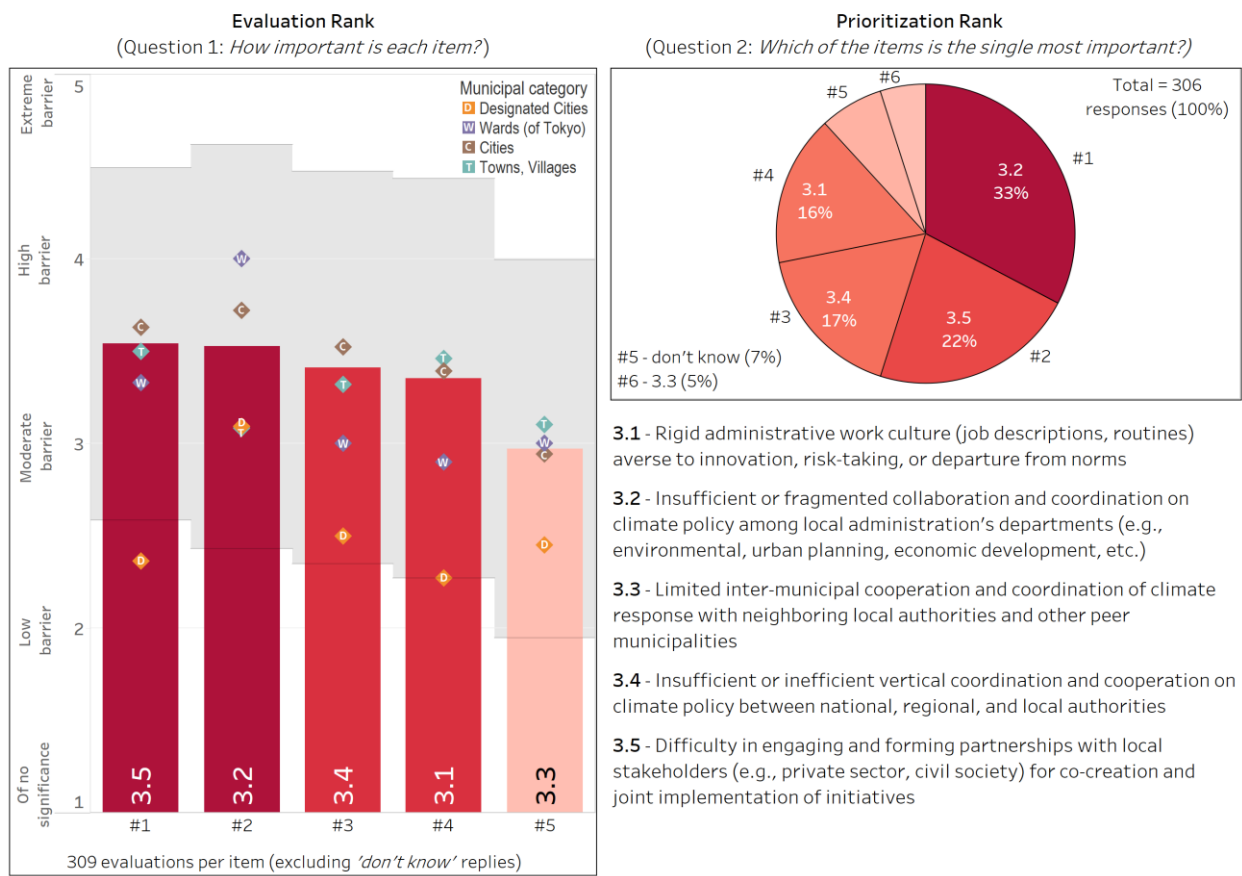
Overall, these results illustrate the seriousness of *the insufficient climate expertise among local administrators* (B2.1) and *the shortage of practical tools and methodologies* (B2.3) across most municipalities. Notably, designated cities, which have larger populations, seem better equipped with both expertise and tools and tend to view these issues as less significant than other municipal groups.

4.2.2.3 Category III: Institutional Coherence and Coordination Constraints

The third category encompasses the difficulties with the institutional coherence, effective management, and coordination required to achieve net-zero emissions (Figure 4.4). Most respondents rate items in this category as either high or moderate barriers, with average scores hovering around 3.5 (see bar chart). Overall, municipalities attach somewhat lower significance to items in this category compared to items related to municipal capacity constraints (i.e., Sections 4.2.2.1 and 4.2.2.2). Although mean scores across items appear relatively uniform, examining respondents' single-item priority rankings (see pie chart) reveals a more nuanced picture, highlighting two particularly critical barriers in this category.

⁸ This does not suggest an absence of strategy development. Rather, it reflects limited in-house technical expertise for independently designing and operationalizing net-zero strategies. Municipalities were at different stages of policy preparation at the time of the survey, and in some cases external consultants may have been involved in technical aspects of strategy drafting.

Figure 4.4. Barriers to achieving net-zero emissions by municipalities (Category III: Institutional coherence and coordination issues)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

For a third (33%) of the surveyed municipalities, the most significant challenge is *insufficient collaboration and coordination on climate policy among local administration's departments* (B3.2), such as environmental, urban planning, economic development, and other relevant agencies. Scholars have consistently emphasized that effective climate action must be recognized as a multi-sectoral endeavor—one that extends beyond environmental divisions to engage various policy domains (Aylett, 2015; M. M. Betsill, 2001; Bulkeley et al., 2009). Yet, the findings reveal that many municipalities continue to face obstacles in achieving the necessary cross-departmental alignment. This issue appears especially salient for Tokyo wards and cities, likely due to their more complex administrative structures compared to smaller municipalities, where bureaucracies are more compact.

The difficulty of engaging and forming partnerships with stakeholders (B3.5) emerges as an equally significant barrier. Proactive engagement with and involvement of stakeholders is crucial not only for building a strong consensus around climate action but also for joint co-development and implementation of initiatives. Nearly one-quarter (22%) of municipalities selected stakeholder engagement as their primary challenge within this category.

Vertical coordination between national, prefectural, and municipal levels of government (B3.4), along with rigid administrative practices within local governments (B3.1), also pose notable challenges, though slightly fewer municipalities (17% and 16%, respectively) cited these as their primary barriers. The former underscores ongoing difficulties in aligning hierarchical governance structures to enable effective local action. The latter reflects how rigid conservative administrative routines and procedures, often averse to change and innovation, can slow municipalities' response to climate-related demands. These two factors tend to be perceived as more challenging by medium and smaller municipalities, whereas designated cities and Tokyo wards report fewer constraints in these areas.

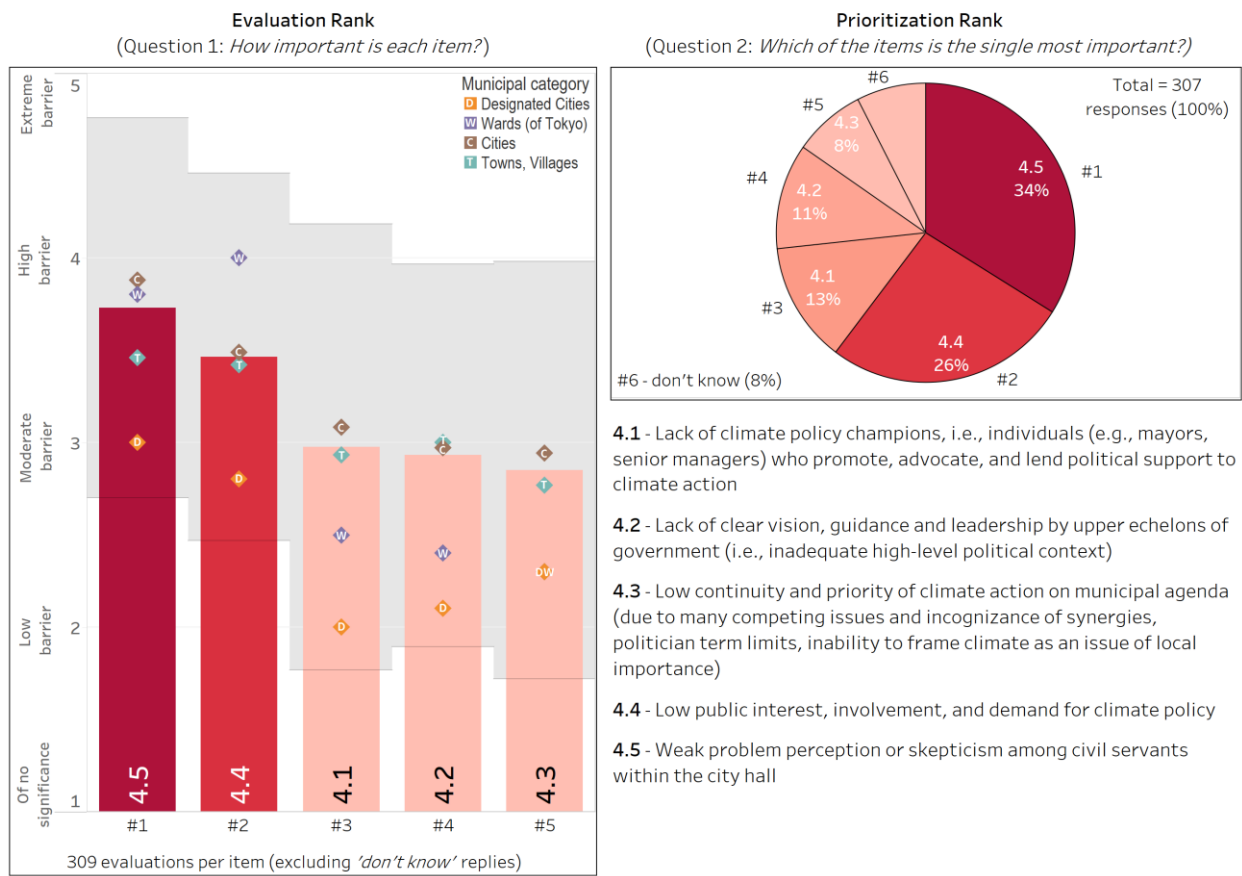
Noticeably, designated cities generally perceive institutional barriers as less severe compared to other municipal types. This likely reflects their greater resources and more direct communication with the national government (due to their “designated” status), whereas regular cities and towns typically coordinate through prefectural authorities, and Tokyo's special wards primarily interact with the Tokyo metropolitan government. Nonetheless, *insufficient inter-departmental collaboration* (B3.2) consistently emerges as a significant challenge for designated cities as well. Together with *the difficulty of engaging and involving stakeholders* (B3.5), these two barriers prominently represent the core institutional coherence issues faced by most municipalities in advancing their net-zero commitments.

4.2.2.4 Category IV: *Insufficient Leadership and Political Will*

Political will and leadership-related issues are the final category of barriers, addressed under Category IV (Figure 4.5). Items here received overall lower significance scores than those in other categories, with two barriers standing out.

Weak climate awareness or skepticism among municipal staff and decision-makers (B4.5) emerges as the most prominent barrier in this category, receiving the highest mean score of 3.7 and identified as the single most critical barrier by approximately one-third (34%) of municipalities. This finding likely reflects the difficulty faced by climate-focused municipal staff in fostering broader acceptance within city halls about the importance of the net-zero objective. Limited commitment from top administrators and decision-makers can create competing priorities and undermine effective policy implementation. While all municipal categories rate this barrier as significant, designated cities perceive it somewhat less severely.

Figure 4.5. Barriers to achieving net-zero emissions by municipalities (Category IV: Insufficient leadership and political will)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

Low public interest, involvement, and demand for climate policy (B4.4) was evaluated second on average in this category, and prioritized by approximately one-quarter (26%) of respondents. Given that successful local climate initiatives depend heavily on residents’ support and active demand for climate policies, this finding highlights officials’ concern regarding low community interest and awareness.

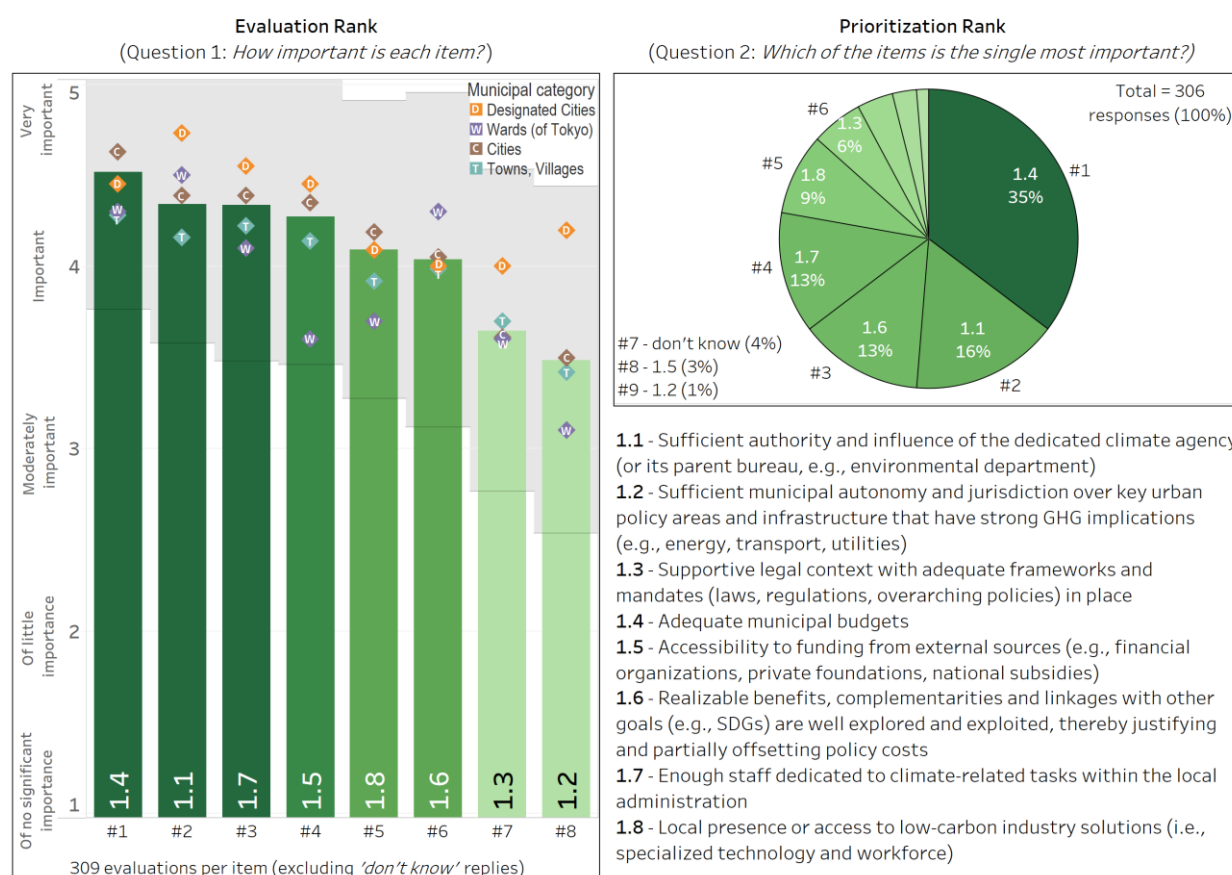
Other barriers received relatively modest ratings. Designated cities particularly tended to downplay the severity of this category’s factors. A relatively high share of respondents (8%) selected "I don't know," possibly indicating officials' hesitancy to respond to politically sensitive topics. Nonetheless, the survey clearly reveals municipal willingness to highlight internal administrative challenges, with *skepticism and weak climate awareness within city halls themselves* (B4.5) emerging prominently as the category's most critical barrier.

4.2.3 Survey Results: Enablers

4.2.3.1 Category I: Municipal Capacity Enablers - Authority and Resources

Adequate municipal capacity in terms of resources and authority emerges as the category with the highest-rated enabling conditions in the survey. Six enablers achieve mean scores above 4, indicating their high significance for most responding municipalities (Figure 4.6).

Figure 4.6. Enablers facilitating achieving net-zero emissions by municipalities (Category I: Adequate municipal capacity—resources and authority)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

Mirroring the findings from the barriers section (Section 4.2.2.1), the most prominent enabling condition is *the availability of an adequate municipal budget* (E1.4). Unlike the barriers section, however, *having sufficient authority and influence by the dedicated municipal climate agency* (E1.1) emerges as the second-highest-rated enabler on average, and it is identified as the single most important enabler by 16% of respondents (49 out of 306). This result is particularly

noteworthy, as it indicates that most respondents believe that not only funding but also an empowered climate agency may significantly enable municipal net-zero efforts.

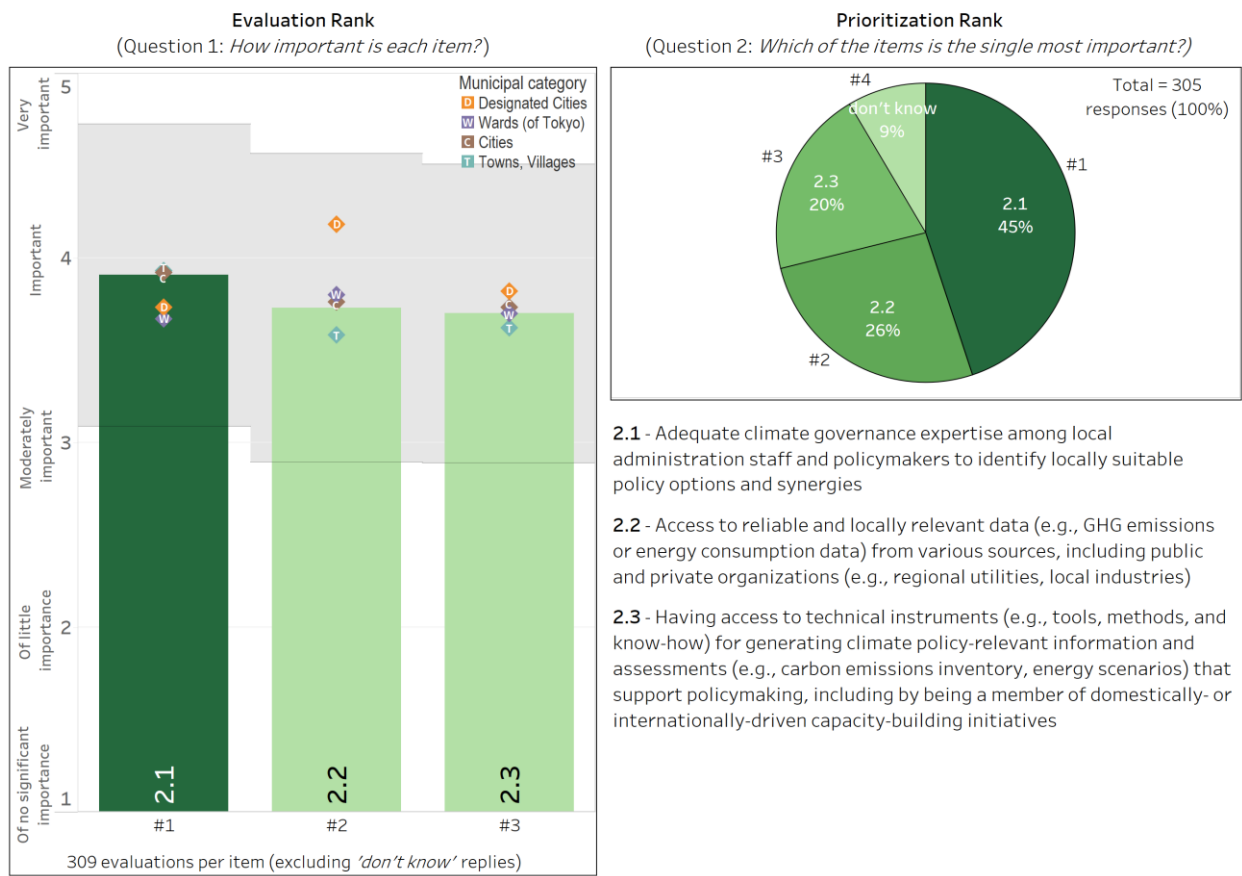
The availability of sufficient staff dedicated to climate-related tasks (E1.7), and the accessibility to external funding (E1.5), as well as the presence and recognition of realizable benefits and complementarities with local policy priorities (E1.6), and the local availability of technology and a skilled workforce (E1.8), are also identified as significant enabling conditions that may substantially enhance municipalities' net-zero progress.

4.2.3.2 Category II: Municipal Capacity Enablers - Knowledge and Expertise

Municipal capacity enablers related to knowledge and expertise are all considered equally important by municipalities overall (Figure 4.7, bar chart), albeit not as significantly as most resource- and authority-related enablers from Category I. When asked to identify the single most important enabler in this category, nearly half of the municipalities (45%) prioritize *adequate climate governance expertise among municipal policymakers and staff (E2.1)* (see pie chart). This result echoes findings from Category II barriers (Section 4.2.2.2), thereby further emphasizing the primary necessity of having adequate expertise in municipal administrations for developing effective climate measures.

In contrast to barriers, however, *access to reliable and relevant local data (e.g., GHG emissions, energy consumption) (E2.2)* is considered the most significant enabler by a slightly higher proportion of municipalities (26%) compared to *having access to necessary tools and instruments to support policymaking (E2.3) (20%)*. Designated cities, in particular, attach more significance to the former than the latter. This may indicate that larger cities with greater administrative capacities face challenges primarily in obtaining necessary data rather than in lacking the technical capabilities to process it. In contrast, for smaller cities, being perhaps at earlier stages of their climate response, and with fewer human resources, both of the above enablers seem equally important.

Figure 4.7. Enablers facilitating achieving net-zero emissions by municipalities (Category II: Adequate municipal capacity—knowledge and expertise)

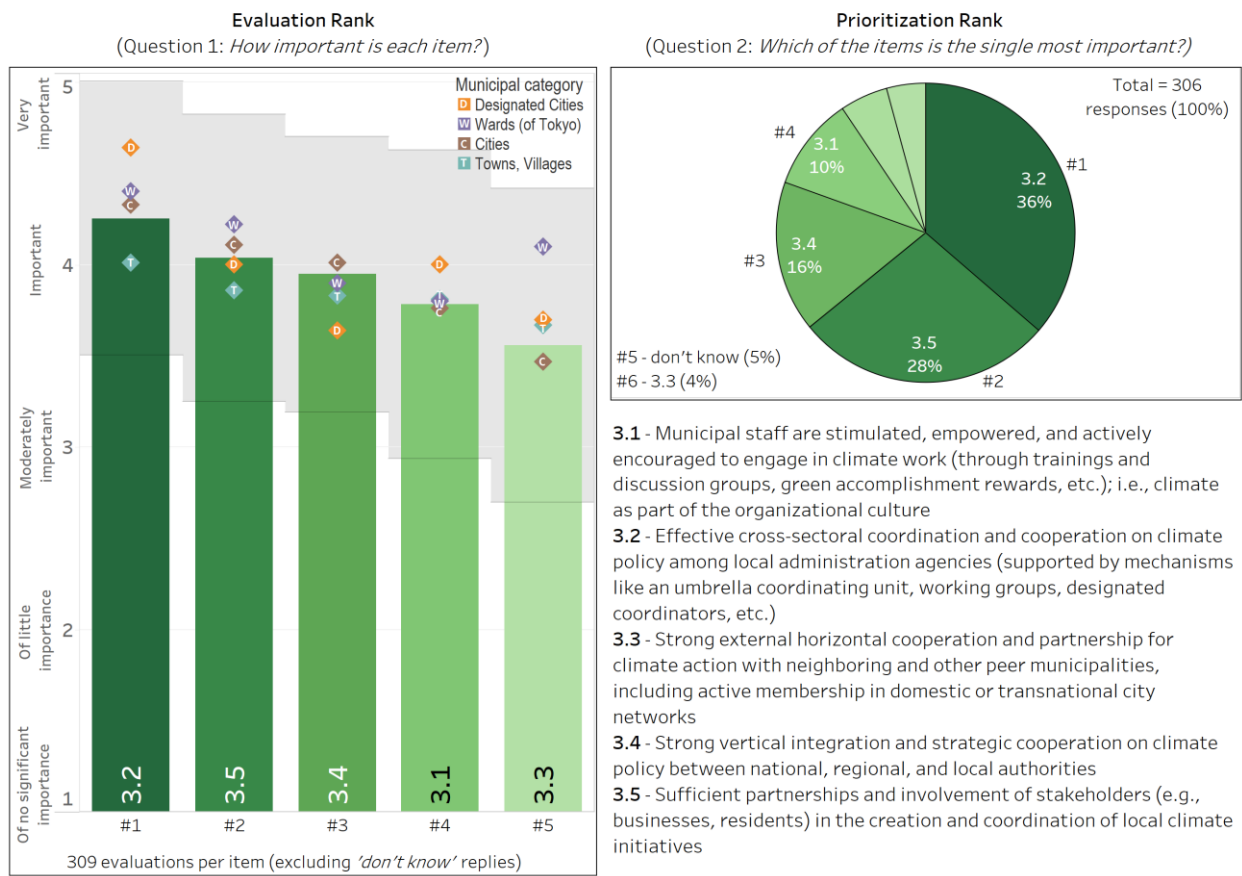


Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

4.2.3.3 Category III: Institutional Coherence and Coordination

Institutional coherence and coordination represent enabling factors related to effective organizational management of municipal agencies and cooperation across sectors and stakeholders (Figure 4.8). Such coordination can occur horizontally among administrative departments and vertically between different levels of government. Beyond the confines of the city hall, it also includes fostering closer partnerships with the private sector, academic institutions, civil society, and peer municipalities. In short, organizational coherence and coordination is about creating a collaborative ecosystem where government entities and various stakeholders work collectively toward common climate objectives. Overall, municipalities consider most factors in this category important, with average ratings around the value of “4” (“important enabler”) and relatively consistent evaluations across municipal groups (see bar chart).

Figure 4.8. Enablers facilitating achieving net-zero emissions by municipalities (Category III: Institutional coherence and coordination)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

Coordination across different administrative agencies representing diverse sectors (E3.2) is the top enabler in the category, receiving the highest average score and being identified as the single most important by every third municipality (36%). The opposite of this enabler (insufficient coordination) is also viewed as the top barrier (see Section 4.2.2.3), indicating the acuteness of this issue faced by most municipalities pursuing net zero. Considering that many municipalities are relatively new to climate action, establishing an organizational structure that fosters collaboration among different agencies within the administration seems to be one of the priority enablers for advancing their climate-related efforts.

Effective cooperation and engagement with local stakeholders (E3.5) emerges as another essential enabling condition, viewed by 28% of municipalities as the topmost enabler in this category. This finding highlights local officials’ clear recognition that municipal governments

cannot achieve net-zero objectives without active collaboration with the private sector and civil society. At the same time, as also emerged in the barriers results (Section 4.2.2.3), municipalities frequently struggle to effectively leverage stakeholder engagement, underscoring the importance and challenge of this factor.

Other factors, such as *effective vertical governance* (E3.4) and *stimulated and empowered municipal staff actively encouraged to engage with climate work* (E3.1), are also viewed as significant enabling conditions, though prioritized by fewer municipalities (16% and 10%, respectively).

Interestingly, *strong horizontal cooperation with peer municipalities* (E3.3) comes last in the ranking. This finding is rather contrary to expectations, given that academic literature often emphasizes the facilitating role of transnational city networks.

Overall, the rankings of enabling factors in the institutional coherence category closely mirror findings from the corresponding barriers category, indicating that addressing the most acute barriers can effectively contribute to a better enabling environment. Improving *cross-departmental cooperation* (E3.2) and *stakeholder engagement* (E3.5) appear to be particularly promising areas for focus.

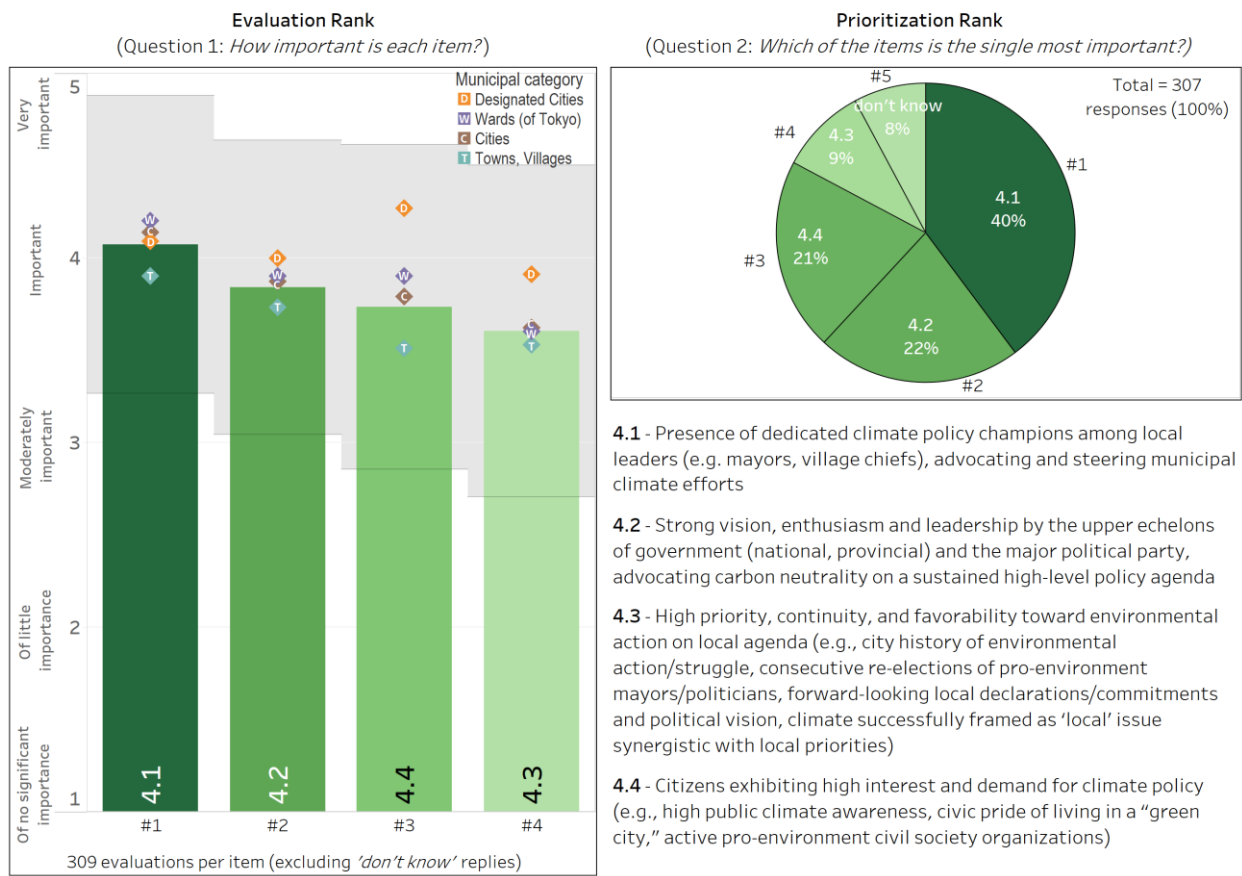
4.2.3.4 Category IV: Strong Political Will and Leadership

The final survey category—enablers related to political will and leadership (Figure 4.9)—includes factors reflecting actors’ proactive stances on climate policy. Overall, municipalities rate enabling conditions in this category notably higher (means ≈ 4) compared to corresponding barriers (means ≈ 3) (see also Section 4.2.2.4). Also, a rather different set of items emerges at the top compared to barriers, highlighting their asymmetrical nature.

The most prominent enabler in this category is *the presence of climate policy champions among local leaders* (E4.1). This item receives the highest average evaluation (mean above 4), and notably, 40% (122 out of 307) of municipalities select it as the single most important factor. Such a result is a testament to the important role of local leaders—including mayors, chiefs, or governors—in mobilizing political and institutional resources to advance the net-zero agenda.

Other significant enablers include *strong vision, enthusiasm, and leadership by the upper echelons of government* (E4.2), and *citizens exhibiting high interest and demand for climate policy* (E4.4). The former speaks to a strong, proactive stance on climate policy by the national government and ruling political parties, which contributes to a high-level political environment conducive to local-level action. The latter highlights a similarly crucial theme—that residents have a high awareness of the issue and support the government’s climate initiatives. Out of all respondents, 22% and 21% respectively chose these items as their most important ones.

Figure 4.9. Enablers facilitating achieving net-zero emissions by municipalities (Category IV: Strong political will and leadership)



Note: Bars represent the mean evaluation scores of each item across all municipalities (± 1 standard deviation shown in gray). Colored diamond markers show mean scores by municipal type. The pie chart displays the proportion of municipalities selecting a specific item as "the single most important" within its category (percentages may not total 100% due to rounding). Source: Created by the author based on survey response data (software: Tableau Desktop ver. 2025.1.2).

All items within this category are rated relatively equally across different municipal groups, suggesting that political will and leadership enablers hold similar importance regardless of municipalities’ population size or administrative status. One slight exception involves designated cities – they place somewhat greater emphasis on *citizens’ interest and support for climate policy* (E4.4). This highlights the importance of citizen awareness, in addition to the enthusiasm from local leaders and high-level government tiers.

4.2.4 Correlation Analysis

I conducted a Spearman’s rank correlation analysis on the survey response dataset to empirically test the assumptions underlying the analytical framework introduced in Chapter 2. Many factors showed statistically significant positive correlations in municipalities’ perceptions of their importance, with most correlation coefficients ranging from negligible to weak (0.1–0.3) to

moderate (0.3–0.5), and occasionally strong (over 0.5). Strongly correlated barrier–enabler factors are shown in Table 4.1 (for full results of the correlation analysis, see Appendix C). The presence of many moderate and some strong correlations confirms the initial assumption of relationships among factors, validating an integrated depiction of MBEs within the framework, as illustrated in Figure 2.1.

Table 4.1. Prominent correlations between the salient local climate governance factors (based on survey data of Japanese municipalities working toward net-zero)

Factor 1	Factor 2	Correlation Values
B1.2. Limited municipal autonomy over key policy areas and infrastructure	B1.3. Inadequate legal/regulatory frameworks	0.558 ($p < 0.05$) $n = 294$
B1.4. Constrained municipal budgets	B1.5. Limited accessibility to funding from external sources	0.667 ($p < 0.05$) $n = 295$
B2.2. Limited access to reliable and locally relevant data necessary for climate action	B2.3. Lack of methods, tools, and best practices for creating climate policy-relevant information and assessments	0.518 ($p < 0.05$) $n = 302$
B3.2. Insufficient inter-departmental collaboration and coordination on climate policy in the local administration	B4.5. Weak problem perception or skepticism within the city hall	0.594 ($p < 0.05$) $n = 302$
B3.4. Insufficient vertical coordination and cooperation between national, regional, and local authorities	B4.2. Lack of clear vision, guidance, and leadership by the upper echelons of government (high-level political context)	0.542 ($p < 0.05$) $n = 302$
B4.1. Lack of climate policy champions	E4.3. High priority, continuity, and favorability toward environmental action on local agenda	0.515 ($p < 0.05$) $n = 301$
B4.3. Low continuity and priority of climate action on municipal agenda	E4.1. Presence of dedicated climate policy champions among local leaders	0.544 ($p < 0.05$) $n = 296$
E1.1. Sufficient authority and influence of the dedicated climate agency	1.7. Enough staff dedicated to climate-related tasks within the local administration	0.517 ($p < 0.05$) $n = 293$
E1.5. Accessibility to funding from external sources	E1.4. Adequate municipal budgets	0.626 ($p < 0.05$) $n = 283$
E1.7. Enough staff dedicated to climate-related tasks within the local administration	E1.8. Local access to low-carbon solutions (e.g., technology and workforce)	0.506 ($p < 0.05$) $n = 304$
E3.1. Municipal staff are stimulated, empowered, and actively encouraged to engage in climate work (climate-conducive administrative work culture)	E3.2. Effective cross-sectoral coordination and cooperation on climate policy among local administration agencies	0.736 ($p < 0.05$) $n = 304$
E3.4. Effective vertical climate governance across all government levels (national, regional, local)	E3.5. Strong stakeholder engagement (e.g., businesses, residents) in local climate action	0.548 ($p < 0.05$) $n = 298$
E3.5. Strong stakeholder engagement (e.g., businesses, residents) in local climate action	E4.4. Citizens exhibiting high interest and demand for climate policy	0.528 ($p < 0.05$) $n = 304$
E4.3. High priority, continuity, and favorability toward environmental action on local agenda	E4.4. Citizens exhibiting high interest and demand for climate policy	0.511 ($p < 0.05$) $n = 300$

The Spearman’s rank correlation analysis was conducted on Likert-scale survey responses of municipal officials’ perceptions of factor importance. With excluded “I don’t know replies”, n ranges from 276 to 305; p -values are two-tailed. This table shows factors exhibiting moderately strong correlations (Spearman’s ρ over 0.5). Codes “B” and “E” indicate barriers and enablers, respectively. For correlation values of all motivations, barriers, and enablers, see Appendix C. Source: Author’s analysis (software MAXQDA 2024).

Specifically examining the symmetry between conceptually mirrored barrier–enabler pairs, I found all correlations to be positive, with the majority exhibiting negligible-to-moderately weak

correlations ($\rho = 0.1\text{--}0.4$), with only a few pairs showing moderate ($\rho = 0.4\text{--}0.5$) and moderately strong correlations ($\rho = 0.5\text{--}0.6$) (see Table 4.2). These results align well with the analytical assumptions and prior literature, which suggest that barriers and enablers can indeed be viewed as mirrored opposites at a conceptual level, but should not be presumed strictly symmetrical in perceived importance (see Section 2.3).

Table 4.2. Correlation between the salience of barriers and enablers that are conceptual mirrors (based on survey data of Japanese municipalities working toward net-zero)

Barrier–Enabler Pairs (Conceptual Opposites)	Correlation Values
B1.1—1.1 (Limited/Sufficient) authority and influence of the dedicated municipal climate agency	0.282 ($p < 0.05$) $n = 303$
B1.2—E1.2 (Limited/Sufficient) municipal autonomy over key policy areas and infrastructure that have strong GHG implications	0.277 ($p < 0.05$) $n = 295$
B1.3—E1.3 (Inadequate/Supportive) legal/regulatory frameworks	0.354 ($p < 0.05$) $n = 292$
B1.4—E1.4 (Constrained/Adequate) municipal budgets	0.518 ($p < 0.05$) $n = 302$
B1.5—E1.5 (Low/High) accessibility to funding from external sources	0.483 ($p < 0.05$) $n = 295$
B1.6—E1.6 (High upfront/Offset via synergies) policy costs	0.267 ($p < 0.05$) $n = 294$
B1.7—E1.7 (Lack of/Enough) staff or staff-time allocated to climate-related tasks in local administration	0.594 ($p < 0.05$) $n = 302$
B1.8—E1.8 (Limited/Adequate) access to technological options and skilled workforce in the local area	0.355 ($p < 0.05$) $n = 286$
B2.1—E2.1 (Lack of/Adequate) specialized knowledge and expertise among local administration staff	0.340 ($p < 0.05$) $n = 296$
B2.2—E2.2 (Limited/Adequate) access to reliable and locally relevant data necessary for climate action	0.406 ($p < 0.05$) $n = 299$
B2.3—E2.3 (Lack of/Adequate) methods, tools, and best practices for creating climate policy-relevant information and assessments	0.312 ($p < 0.05$) $n = 299$
B3.1—E3.1 (Risk-averse/Innovation-conducive) administrative work culture	0.214 ($p < 0.05$) $n = 299$
B3.2—E3.2 (Insufficient/Effective) inter-departmental collaboration and coordination on climate policy in the local administration	0.393 ($p < 0.05$) $n = 301$
B3.3—E3.3 (Limited/Strong) inter-municipal cooperation and coordination with neighboring and other peer local authorities	0.190 ($p < 0.05$) $n = 290$
B3.4—E3.4 (Insufficient/Effective) vertical coordination and cooperation between national, regional, and local authorities	0.316 ($p < 0.05$) $n = 298$
B3.5—E3.5 (Difficulty in/Strong) engagement and partnerships with local stakeholders for co-creation and joint implementation	0.204 ($p < 0.05$) $n = 293$
B4.1—E4.1 (Lack of/Presence of) climate policy champions	0.207 ($p < 0.05$) $n = 289$
B4.2—E4.2 (Lack of/Strong) vision, guidance, and leadership by the upper echelons of government (high-level political context)	0.101 ($p = 0.0859$) $n = 291$
B4.3—E4.3 (Low/High) continuity and priority of climate action on municipal agenda	0.213 ($p < 0.05$) $n = 279$
B4.4—E4.4 (Strong/Weak) public interest, involvement, and demand for climate policy	0.228 ($p < 0.05$) $n = 290$

The Spearman’s rank correlation analysis was conducted on Likert-scale survey responses of municipal officials’ perceptions of factor importance. The shown barrier–enabler pairs are conceptual opposites (e.g., limited versus adequate resources or conditions). Source: Author’s analysis (software MAXQDA 2024).

Finally, the analysis also revealed certain factors whose importance ratings correlated with numerous other factors (see Table 4.3). These factors might act as high-leverage points, potentially influencing multiple related barriers or enablers if effectively addressed. Notably, among the top seven of these highly interconnected factors, five belong to Category 3 (Institutional coherence),

indicating that local officials view municipalities' climate efforts as significantly dependent on organizational culture, coordination, and cooperation among actors.

Table 4.3. Salient local climate governance factors correlating with over 10 other factors (based on survey data of Japanese municipalities working toward net-zero)

N	MBE Item	N of Correlated Factors ($p > 0.3$)
1	E2.1. Adequate climate governance expertise among local administration staff and policy-makers	15
2	E3.1. Municipal staff are stimulated, empowered, and actively encouraged to engage in climate work (climate-conducive administrative work culture)	15
3	E3.4. Effective vertical climate governance across all government levels (national, regional, local)	14
4	E1.8. Local access to low-carbon solutions (e.g., technology and workforce)	13
5	E3.2. Effective cross-sectoral coordination and cooperation on climate policy among local administration agencies	13
6	B3.5. Difficulty in engaging and forming partnerships with local stakeholders for co-creation and joint implementation	13
7	E3.5. Strong stakeholder engagement (e.g., businesses, residents) in local climate action	13
8	E1.1. Sufficient authority and influence of the dedicated climate agency	11
9	E2.2. Access to reliable and locally relevant data	11
10	E4.4. Citizens exhibiting high interest and demand for climate policy	11

The table shows factors exhibiting moderate-to-strong correlations ($p > 0.3$) with numerous other motivations, barriers, and enablers (MBEs). Factors correlating with over 10 others are shown (ordered from the most frequently correlated). Codes “B” and “E” indicate barriers and enablers, respectively. For correlation values of all MBE factors, see Appendix C. Source: Author’s analysis (software MAXQDA 2024).

4.3 Discussion and Implications

4.3.1 Major Motivations

4.3.1.1 Dominance of Economic Motivations and Space for Broader Motivational Perspectives

Earlier survey studies identified “energy and cost savings” (Krause, 2013), “local development” (Aylett, 2014), and “saving money” (Salon et al., 2014) as major motivations for local governments pursuing climate action. While the quantitative findings from surveying net-zero committed Japanese municipalities broadly align with this literature, they also highlight more nuanced motivational factors. Specifically, the three top-ranked motivations (prioritized by 57% of respondents) revolve around opportunities to enhance municipal energy conditions (e.g., promoting “local generation local consumption” renewable energy initiatives), achieve direct financial gains (e.g., cost savings through improved energy and resource efficiency), and support local economic revitalization (e.g., reviving local industries through green sector development) (see Figure 4.1). These results also confirm broader, national-level analyses. For instance, Kameyama’s (2016) study of Japan’s climate policy history between 1980s and 2015 observed that climate change discourse in Japan had been framed mainly in economic and energy policy terms (Kameyama, 2016).

Confirming the potency of economic and local development rationales for local government climate action, these findings carry several implications. First and foremost, they further emphasize that economic opportunities represent some of the strongest motivations driving municipalities and thus can be strategically leveraged. For instance, policy planners can promote opportunities such as increased local energy autonomy, new revenue streams, economic revitalization, and job creation, thereby aligning climate initiatives more closely with local development priorities, attracting private-sector engagement, and building a strong economic case for local action toward net zero. Success stories demonstrating effective leveraging of these opportunities, such as the floating offshore wind power project in Goto City, for instance, can serve as inspiring examples (Myasoedov & Ota, 2021).

At the same time, however, scholarly literature cautions that an overemphasis on economic and technological rationales also presents risks. Krause (2013) cautions that local governments driven primarily by financial objectives tend to develop less comprehensive climate plans and show lower implementation commitment (Krause, 2013). Similarly, Kameyama (2016) observed that Japan has historically focused on solutions related to energy efficiency and related technology export overseas—largely reflecting economic concerns—with less discussion of broader long-term environmental strategies beyond incremental technology improvements (Kameyama, 2016). Overall, there is a risk that local climate strategies narrowly focused on financial gains and technological solutions may attract only limited support (primarily from stakeholders directly benefiting economically) and may propagate a short-term focus on immediate costs, potentially overlooking broader synergies and long-term co-benefits.

One potential strategy to mitigate such risks is to promote climate action's linkages with widely shared people's values: safety, health, autonomy, etc. Doing so is also highlighted by scholars as a core principle of effective climate communication and public engagement (Sippel et al., 2022). Such approach could expand stakeholder engagement, enable more comprehensive policy design, and strengthen the long-term viability of local climate initiatives. In this light, insights into other highly valued motivations from the survey, beyond economy-related ones, could prove useful.

For instance, the survey revealed that ensuring residents' safety through climate measures that enhance local resilience is a highly rated motivation among many municipalities (ranked 4th in the results). In the Japanese context, the emphasis on safety likely reflects a historical awareness of frequent natural disasters. However, safety and resilience may also serve as compelling motivators for municipalities globally, especially considering rapidly escalating climate-induced disaster risks. This motivation, reflecting widely shared concerns, offers a unifying rationale that can mobilize support across diverse stakeholder groups, bridging political divides and conflicting interests.

Further, improving quality of life (QoL) and public health is another relatively high-ranked motivation, as shown by the survey. The literature notes that emphasizing and promoting well-being and health-related co-benefits further offers a promising strategy for enhanced stakeholder support, public engagement, and cross-sectoral coordination (Denton et al., 2022, p. 1756), as well as more sustained action amid crises (O’Garra et al., 2024). Notably, however, the survey indicates that this motivation, although ranked relatively highly (rated “important” on average and prioritized by 12% of respondents), remains overshadowed by stronger aspirations related to economic development opportunities and safety concerns. This suggests that the potential of QoL improvements as a compelling narrative for climate action remains underutilized in Japanese municipalities—and I believe it merits greater emphasis beyond Japan as well.

In sum, while the quantitative survey findings confirm the dominance of the “local economy and development” motivation cluster in driving municipal climate actions, they also show that those related to widely shared people’s values, such as “safety and resilience” or “quality of life and health”, increasingly contribute to this drive. As these broader motivations remain somewhat overshadowed by economic objectives, there is significant potential—in Japan and beyond—to better highlight and leverage them, thereby further enhancing the adoption of ambitious climate policies, ensuring wider stakeholder support, and sustaining long-term commitment to action.

4.3.1.2 Embracing Local Aspirations

An earlier large-scale survey by Aylett (2014) found that “generating political capital” was the highest-rated motivation theme for municipal mitigation planning among ICLEI-member cities (Aylett, 2014). More recent studies, such as analyses of municipal climate emergency declarations, similarly emphasized “political positioning and international signaling” as major motivations behind such proclamations (Ruiz-Campillo et al., 2021). By contrast, the survey of net-zero committed Japanese municipalities revealed that such outward-oriented motivations—i.e., “alignment with higher-level frameworks”, “contributing to global efforts”, “pursuing reputational gains”, or “demonstrating leadership”—were mentioned far less often (in sum, prioritized by 15% of respondents, with average scores around “3” on a five-point Likert scale). Instead, much higher-ranked were inward-oriented place-based motives such as “local economic gains”, “community safety/resilience”, and “quality-of-life/health improvements” (in sum, prioritized by 85% and scoring “4”) (see Figure 4.1).

This distinct dominance of inward, rather than outward, orientation among major municipal motivations is noteworthy. It reflects that Japanese municipalities, in their movement toward net-zero emissions, tend to be driven largely by grassroots motivations rooted in local objectives and tangible community benefits, adopting a pragmatic, locally oriented approach to climate governance. This suggests the significant role of such community-focused motivations, with both

theoretical implications for urban climate governance and practical insights for climate communication and policymaking.

For instance, emphasizing locally resonant co-benefits—that is, making climate action a part and parcel of ground-up community aspirations to improve the overall well-being of their neighborhoods—may represent an important strategy to increase the resilience of climate action amid political shifts and external shocks. Indeed, although without implying causality, observing international experiences hints that climate commitments anchored in community-level co-benefits tend to endure amid higher-level political fluctuations or unforeseen crises. For example, despite the United States' repeated withdrawal from the Paris Agreement, hundreds of American cities vowed to continue their climate initiatives (Arroyo, 2019; Climate Mayors, 2025a). Their mayors cite local job creation, cleaner air, and energy savings as important opportunities, and openly lament that the federal government's backtracking on climate undermines their communities' welfare (Climate Mayors, 2025b, 2025c). Similarly, many cities continued stable climate efforts despite the COVID-19 pandemic and related economic downturn (Jaglom et al., 2020), with links to tangible community co-benefits (like improved public health outcomes) proving particularly important (O'Garra et al., 2024). Complementing these international observations, the survey adds a relevant insight: among the variety of possible motivations driving Japanese municipalities toward net zero, pragmatic, inward-oriented community-based objectives resonate most strongly with local governments, in clear contrast to outward-oriented motives.

This is not to claim that the local net-zero agenda in Japanese municipalities will be particularly effective or resilient to political backtracking just because it is primarily rooted in locally driven motivations. This remains to be seen. Nevertheless, this finding may add valuable insights to ongoing discussions in theories of local governance, such as polycentric and multilevel governance. Both theories have been frequently employed to explain why bottom-up climate governance is often more effective than top-down approaches—epitomized by the success of the Paris Agreement (which ratchets up party-determined commitments), in contrast to the more top-down prescriptive Kyoto Protocol (Jordan et al., 2018), as well as by the emergence of city frontrunners and municipal climate networks actively advancing climate policy amidst sluggish (if not backward) federal action (Bulkeley & Betsill, 2013). Polycentric governance emphasizes the independent roles of multiple actors, driven to self-organize, in part, by perceived local benefits (Ostrom, 2010). In contrast, multilevel governance highlights the significance of municipalities operating both vertically—along hierarchical government levels (e.g., national, regional)—and horizontally, through collaborations with peer cities and other non-state actors (Bulkeley, 2010). In this context, the finding that inward-oriented, community-focused motivations prevail among Japanese net-zero-committed municipalities may add depth to understanding what drives local governments to engage in climate action and why the bottom-up approach tends to prevail over top-down climate

governance models. Building on such insight, future research may further explore and theorize on what this apparent dominance of inward motivations among local governments pursuing net-zero may imply for existing governance theories.

Turning from theory to practice, it seems reasonable to suggest that policymakers and climate communicators—both within Japan and internationally—may benefit from placing greater emphasis on locally meaningful co-benefits when framing climate initiatives. Clearly connecting global mitigation objectives to concrete local improvements in livelihoods, community safety, and quality of life (which emerged as salient motivations in the survey) may help strengthen stakeholder support, buffer climate programs from higher-level political fluctuations, and enhance the sustained long-term engagement with climate policies. This will increase the likelihood that municipalities will make consistent progress and deliver on their net-zero commitments.

Although various applications can be proposed, one specific policy example that leverages these principles is promoting decentralized municipal renewable energy projects, employing business models that generate electricity locally from renewable sources and retain revenue within the community. Such business models are already operating in some Japanese municipalities, such as Miyama City (NEASPEC, 2021) and Goto City (Myasoedov & Ota, 2021). This approach offers significant local benefits, including additional tax revenues that strengthen municipal budgets for broader developmental goals, local job creation through energy project operations and associated manufacturing opportunities, enhanced energy autonomy and supply stability, reduced energy costs, and improved local air quality. Communicators can emphasize these benefits to secure the necessary stakeholder support for municipal energy projects.

4.3.2 Major Barriers and Enablers

4.3.2.1 Municipal Capacity for Net Zero (I): Budgets, Staff, and Climate Teams' Authority

While the “budgetary constraints in municipalities” very often feature as the obstructing factor in local climate action (e.g., Bulkeley, 2011; Jones, 2017; Kern & Alber, 2009; The Global Taskforce of Local and Regional Governments, UCLG, 2021; UN-Habitat, 2022; UN-Habitat, UNESCAP, 2018; van der Heijden, 2019)—including findings in several analogous surveys (e.g., Aylett, 2014; Rhodes et al., 2021; Salon et al., 2014)—the quantitative results from this large-scale survey empirically underscore the paramount salience of this factor across numerous municipalities in Japan relative to many other barriers (see Figures 4.2–4.5). Simultaneously, “adequate municipal budgets” were also identified as the top-ranked enabler (see Figures 4.6–4.9). The imperative of channeling necessary funds toward climate action at the local level is thus further emphasized.

Given that the survey respondents were local officials responsible for net-zero policy, these findings should be interpreted as not simply the general lack of municipal budget (although local

governments do often operate under tight financial constraints), but rather as chronic underfunding related explicitly to climate measures planned and operated by dedicated municipal agencies (e.g., environmental departments). This adds an important nuance, suggesting that necessary budgets could be better distributed and channeled. As mentioned by Burch (2010b), addressing the issue could be “less a matter of creating more capacity than of facilitating the effective use of existing resources” (Burch, 2010a). Still, the general fiscal stress of municipalities is certainly an overarching problem.

Budget issues are intertwined with staffing challenges and the institutional authority of municipal climate departments, both of which emerged prominently in the survey results (see Sections 4.2.2.1 and 4.2.3.1). These findings align with existing scholarly concerns, highlighting that climate governance frequently depends on small climate teams or environmental agencies that are understaffed, inadequately funded, and generally marginalized within municipal administrations. While viewing environmental issues as secondary, many municipalities are reluctant to redirect their already constrained resources toward expanding climate-focused roles and activities, given other competing and immediate local priorities (Aylett, 2014; M. M. Betsill, 2001; Bulkeley et al., 2009; Burch, 2010a, 2010b). Many open-ended qualitative responses confirm this, for instance, as exemplified in this respondent’s statement: “There is a significant shortage of staff, leaving no capacity to dedicate personnel solely to global warming countermeasures. Securing sufficient budget is also difficult.”

Overall, as evidenced among surveyed Japanese municipalities, key municipal capacity factors related to resources and authority, specifically the availability of dedicated funding and personnel, act as key barriers and potentially (if properly addressed) as powerful enabling conditions for local action toward net zero. Given general resource constraints in municipalities—even more so in environment departments—policymakers should consider a more optimal distribution and allocation of both financial and human resources toward net-zero objectives. Relatedly, ensuring *sufficient authority of the dedicated climate agency* (a key enabler) can be a promising strategy, potentially contributing to more efficient coordination and pooling of resources toward climate policy needs. Indeed, this enabler’s perceived importance correlates with 11 other barriers/enablers, indicating its high interconnectedness and hence high potential (see Table 4.3).

4.3.2.2 *Municipal Capacity for Net Zero (II): A Critical Human Expertise Factor*

The findings clearly highlight specialized climate governance expertise among municipal staff as a critical priority. Every second surveyed municipality identified insufficient staff expertise as the most significant knowledge-related barrier—and adequate expertise as a top enabling factor—far surpassing factors related to data or analytical tools (see Sections 4.2.2.2 and 4.2.3.2).

This underscores a clear sequence: without qualified personnel, even high-quality data or advanced instruments may remain underutilized.

The issue is likely exacerbated by chronic staff shortages discussed above (see Section 4.3.2.1). Indeed, international literature notes that climate-related responsibilities often become additional tasks for already overstretched staff (Aylett, 2015; M. M. Betsill, 2001). Qualitative responses, especially by smaller municipalities, corroborate this: “[T]here is no dedicated department here—staff handle these duties alongside other responsibilities, with no full-time specialists. As a result, a lack of specialized knowledge and capacity is unavoidable.”

Yet, addressing expertise gaps through additional staffing is complicated by constrained financial and human resources (as also discussed above). Hence, optimizing resource allocation and workflows to effectively leverage existing human resources remains crucial (Burch, 2010a). In this context, efforts to reduce barriers related to data access and develop easy-to-use technical tools that support policymaking remain relevant. Better availability of climate data and practical analytical methods can amplify the effectiveness of existing staff expertise and contribute directly to improved resource utilization. At the same time, addressing the expertise barrier and transforming it into an enabler promises high leverage, amplifying multiple enablers simultaneously. For instance, savvy climate-governance personnel can access external funding, improve internal coordination, increase stakeholder involvement, etc. Indeed, the correlation analysis conducted on survey responses identified the “adequate climate expertise” enabler as the most interconnected one, with 15 other factors associated with it (see Table 4.3).

Expertise deficits appear particularly acute in smaller jurisdictions compared to larger designated cities, reflecting their often more limited capacities (Aylett, 2015; M. M. Betsill, 2001). National and regional governments might therefore strategically prioritize targeted capacity-building to support these localities. Possible strategies to strengthen municipal expertise include training programs and improving administrative practices. For instance, enhancing the staff rotation system to ensure that in-house expertise accumulates seems necessary. In Japan, municipal staff are frequently transferred between departments. Many respondents highlighted this issue in their open-ended responses, with one stating: “Due to personnel transfers, there are periods when work must proceed without specialized knowledge. I wish skills gained in other departments could be utilized, but I feel that is not currently the case”.

Another strategy is engagement in regional or international municipal networks for knowledge exchange and staff capacity-building (Romero-Lankao, 2012; van der Heijden, 2019). Additionally, academia and public–private entities could play a pivotal role by partnering more closely with municipalities to develop accessible tools and data systems that facilitate informed decision-making.

While the survey findings related to stretched municipal human resources likely reflect the specific Japanese context (marked by an aging society and regional depopulation), they also carry broader international implications—particularly for smaller and lower-capacity municipalities globally—which similarly face significant human expertise challenges as they embark upon net-zero action.

4.3.2.3 Cooperation for Net Zero: City Units' Collaboration and Stakeholder Involvement

Even when municipal staff possess appropriate knowledge, competencies, and skills, a lack of organizational coherence and collaboration among actors can significantly undermine the effectiveness of local climate efforts (van der Heijden, 2021). The survey highlights two particularly salient factors of this nature: cross-departmental coordination within municipalities and effective engagement with local stakeholders.

In Japan's context, the salience of the former likely reflects a broader organizational culture where vertical siloes is still largely the norm, also known as *tatewari gyōsei* (literally “vertically segmented administration”). As highlighted by Samuels (2013), the entrenched bureaucratic fragmentation “has long been a problem in Japanese governance”, for instance, hampering Japan's crisis response during the 3.11 triple disaster (earthquake, tsunami, and nuclear accident) (Samuels, 2013). Indeed, one surveyed official explicitly mentions: “The environment division is already understaffed, and *tatewari gyōsei* further isolates it—this undermines the advancement of climate policy.”

However, the salience of this problem extends beyond Japan's bureaucracy and also reflects a widespread climate governance issue, where climate action is often viewed as a purely environmental issue and thus confined to environmental departments alone, which are typically situated on the margins of administrative structures (Aylett, 2015; Bulkeley, 2010; Bulkeley et al., 2009). Consequently, officials responsible for climate policy find it challenging to implement meaningful action, since effective climate policy requires cooperation and input from multiple relevant sectors (planning, infrastructure, energy, welfare, etc.). Another survey respondent stated: “Because the environmental department is the only unit that leads the city in addressing climate change issues, it is difficult to actually come up with concrete proposals ... and to lead other departments”.

Other challenges (e.g., limited dedicated budgets, staff, authority, and expertise), also highlighted in the survey responses (discussed above), are all exacerbating the overall marginalization of climate policy, making cross-sectoral coordination among municipal departments a key issue. The absence of such coordination is detrimental to climate governance, and, conversely, when present, it strongly enables effective action and helps address many adjacent barriers (e.g., by

facilitating the pooling of necessary resources and expertise across policy sectors and administrative divisions).

To address this, climate governance literature often calls for climate action to be both better “institutionalized” (i.e., through creation of necessary administrative structures to house the climate policy and coordinate it across different sectors and actors) and better “mainstreamed” (i.e., by embedding climate considerations into existing non-climate municipal policies and municipal agencies’ operations) (Bulkeley et al., 2009; Burch, 2010a; Kern & Alber, 2009; UN-Habitat, UNESCAP, 2018). Accordingly, to enhance institutionalization and mainstreaming of climate policy, scholars suggest various measures. These include positioning the coordination of climate policy within the Chief Executive’s office (Bulkeley et al., 2009), creating a dedicated “overarching unit with appropriate competencies for mainstreaming climate policy, supported by issue-specific task forces” (Kern & Alber, 2009), or establishing “multi-departmental steering committees” (Burch, 2010a). Additionally, some scholars advocate integrating accountability mechanisms into different departments—for example, by requiring regular reporting on climate objectives (Bulkeley et al., 2009) or implementing performance management systems to assess multiple departments’ achievements against net-zero targets (Jones, 2017). Other studies highlight that promoting informal communication between climate and non-climate staff, assigning climate coordination roles within various municipal departments, and aligning climate policy objectives with existing non-climate priorities are all effective approaches for facilitating cross-departmental mainstreaming (Aylett, 2015).

In addition to cooperation among municipal departments, effective climate policy requires venturing “beyond the confines of local authorities to engage with stakeholders and communities” (Bulkeley et al., 2009). Municipal governments cannot achieve substantial progress without involving, collaborating with, and partnering across a broad range of private and civil society actors. Such collaboration enables municipal authorities to extend the reach of their initiatives beyond their direct jurisdiction, bridge capacity gaps, and achieve greater impact at scale. Furthermore, engaging residents as key stakeholders helps to enhance transparency in decision-making, achieve greater public acceptance, develop context-specific solutions, and promote necessary behavioral changes. Although comprehensive stakeholder engagement may have certain downsides, such as being time-consuming and costly (Irvin & Stansbury, 2004), it is widely recognized as beneficial and is actively recommended for effective climate governance (Aylett, 2015; Lwasa et al., 2022, p. 879; Romero-Lankao et al., 2018, p. 595; Sippel et al., 2022; UN-Habitat, 2022, p. 255; van der Heijden, 2019). Consistent with existing studies (Anguelovski & Carmin, 2011; Bulkeley et al., 2009; Jones, 2017) and strongly echoed in responses from municipal authorities, the survey results from Japan empirically confirm that stakeholder engagement ranks among both the most critical challenges and the most promising enablers of local climate action. Furthermore, it correlates with

the salience of numerous other barriers and enablers (see Table 4.3), indicating that leveraging stakeholder engagement may simultaneously enhance other aspects of local climate action.

The climate governance literature suggests various approaches to improving stakeholder participation and engagement. Well-designed communication programs and more inclusive modes of policymaking—involving stakeholders in two-way deliberations with the government, including contributions to planning and decision-making—create a greater sense of ownership and enable greater engagement with climate policies (Aylett, 2010; Jones, 2017; Moore, 2012; Sippel et al., 2022). Further, mechanisms such as citizens’ assemblies on climate change, where members of the public participate in learning, deliberation, and developing recommendations, are gaining prominence not only in European contexts (e.g., Climate Assembly UK, n.d.) but also in Japanese municipalities (Citizens Assembly Japan, 2021). Moreover, experimental engagement platforms, often termed “urban living labs,” encourage stakeholders to discuss, collaborate, and experiment with developing and implementing new ideas and initiatives. Among various benefits, these platforms may give birth to surprising and inspiring creative solutions, which, if upscaled, may accelerate transitions toward carbon-neutral futures (Castán Broto & Bulkeley, 2013; Manzini & Staszowski, 2013; Voytenko et al., 2016).

Overall, the findings in Japan highlight the prominence of the horizontal dimension of multi-level governance, particularly intra-municipal coordination and collaboration with stakeholders. Vertical coordination between levels of government also ranked relatively high, but slightly less prominently. Notably, horizontal cooperation between peer municipalities, including through city networks, received the least attention in the survey. This may reflect the comparatively limited institutionalization or perceived relevance of inter-municipal collaboration in Japan’s local governance landscape, with internal coordination and stakeholder engagement seen as more immediate and actionable priorities.

4.3.2.4 Political Will for Net Zero: Champions, Executive Awareness, and Citizen Support

The survey indicates that, despite Zero Carbon City commitments proclaimed, a weak problem perception or skepticism within the city hall remains a critical barrier (see Section 4.2.2.4). Indeed, regarding staff climate awareness, scholars emphasize the importance for city managers to clearly recognize “the potential, necessity, opportunities, and benefits of addressing global concerns in local management,” as well as “the risks and consequences of not doing so” (Bai, 2007). A lack of such awareness has also been noted as “a factor behind slow governmental reactions” on climate (Qi et al., 2008). Consequently, addressing the barriers and leveraging the enablers described in earlier sections becomes significantly more challenging when municipal managers themselves remain unconvinced or skeptical about climate action.

Low interest, involvement, and demand for climate policy by the residents further exacerbate the problem. The influence of local residents on government decision-making is significant, and a high level of public support is necessary for the development and implementation of successful climate policies. Local constituencies' lack of awareness, poor grasp of climate science, or simply lack of concern (i.e., “not my business”) limits the policy options that local government can justify or is willing to adopt (Bai, 2007; Jones, 2017). Relatedly, increased public awareness is critical for promoting the behavioral change toward low-carbon lifestyles—an inherently complex “wicked” problem with no easy solutions (Jones, 2017, p. 83; Moore, 2012; Sippel et al., 2022). Furthermore, strong public support underpins successful stakeholder engagement and deliberative processes (UN-Habitat, 2022, p. 152), which, as discussed previously (Section 4.3.2.3), play important roles in enabling local climate action.

When residents express strong concern for climate issues, promoting and adopting climate policies becomes a matter of common sense for municipal leaders who are responsive to voter demands (Engel, 2006). However, in the absence of such public concern, proactive climate policy champions are essential to elevate and sustain climate action as a municipal priority. Indeed, the survey clearly identified the presence of dedicated climate policy champions among local leaders as one of the most significant enabling factors toward effective local climate action. Interestingly, while the absence of climate policy champions is not necessarily perceived as a major barrier, their presence emerges as a highly salient enabler. This underscores the substantial added value that dedicated climate policy leaders provide in driving municipal climate initiatives forward.

Indeed, a substantial body of literature underscores the critical role played by individual leaders in initiating, championing, and advancing policy innovations (Kingdon, 2013), including those related to climate action (Bulkeley, 2011; Krause, 2011; van der Heijden, 2019). Such climate champions (often influential municipal executives, senior administrators or political figures like mayors and governors) serve as catalysts for local climate initiatives (Jones, 2017, p. 64). Numerous studies demonstrate how visionary mayors and other proactive leaders have effectively driven low-carbon transitions across various urban policy sectors, including renewable energy, transportation, and green building initiatives (Anguelovski & Carmin, 2011; M. M. Betsill, 2001; Bulkeley et al., 2009; Lee & Koski, 2012; Qi et al., 2008). This survey adds further empirical support to the literature, highlighting the importance of climate policy entrepreneurs in creating an enabling environment for climate action, as reflected in responses from numerous municipalities across Japan.

Overall, the findings suggest that enhancing climate awareness among municipal executives and residents alike and cultivating proactive local climate leaders are essential for overcoming political inertia and sustaining climate actions. Policymakers might therefore prioritize various interventions targeting these aspects to improve the overall political will and leadership

environment. For instance, they can promote and clearly communicate tangible local benefits of climate policies (in this regard, the insights into key motivations described in Section 4.3.1 could be particularly relevant). Additionally, they can initiate climate education and awareness-raising activities (Bai, 2007; Bulkeley et al., 2009; Sippel et al., 2022) and foster meaningful interactions between city officials and residents to build trust (Jones, 2017, p. 41). Furthermore, municipalities can increase their leaders' (e.g., mayors) engagement with climate through regional and international training platforms (e.g., the Asia-Pacific Mayors Academy (Bunsell et al., 2023)), thus raising their “climate champion” qualities. In sum, addressing low awareness (both in city halls and among residents) and fostering local climate leaders could create an enabling environment that supports local climate action.

4.3.3 Applicability Beyond Japan

While the survey results are grounded in the Japanese context, many of the findings are expected to have broader relevance. The analytical framework and its broad categories, which I developed from international literature, are not Japan-specific and can be applied across diverse municipal contexts. Although the relative salience of specific factors identified by Japanese municipalities may differ in other contexts, many of the key items are likely to resonate widely with other cities globally.

Operating under a unitary governance structure (as opposed to federal systems), Japanese municipalities—with the exception of large, affluent cities—typically possess limited formal authority and remain fiscally dependent on the national government (NEASPEC, 2021; UNCRD, 2014). This reliance on external support—for financial, technical, and human resources, as well as specialized expertise—is a condition likely shared not only by other unitary states but also by many cities in developing countries, where such capacity shortfalls are often particularly acute. Therefore, the findings on key capacity-related barriers and enablers (Category I: Authority and Resources and Category II: Knowledge and Expertise)—including the importance of sufficient budgets, skilled personnel, climate department authority, staff climate expertise, and other highly ranked factors—are likely to be relevant to a broad range of non-frontrunner municipalities globally. Furthermore, previous survey studies of local governments in federal countries (e.g., Canada, USA) have also identified some of these key factors as significant (Rhodes et al., 2021; Salon et al., 2014), backing the broad applicability of the findings.

Findings related to Categories III (Institutional Coherence) and IV (Leadership and Political Will) also offer instructive insights applicable beyond the Japanese context. For instance, improving multi-level governance and overall institutional cohesion by strengthening cooperation and coordination with local and external actors, peer municipalities, and higher-level governments—all of which are evaluated as key enablers in the survey— is likely to be a universal

strategy for addressing the capacity shortages discussed above. Networking, collaboration, and joint implementation help pool resources and expertise, combine efforts, and increase efficiencies (Hsu et al., 2017; Lwasa et al., 2022). Likewise, across cities with diverse governance and income contexts, a lack of political will, stemming from low climate awareness among both the general public and public officials, prevents local climate action from being prioritized on the local agenda. Raising climate consciousness among local actors, including through the involvement of dedicated climate champions (a key enabler identified in the survey), will be important in a wide range of municipal settings.

With this backdrop, insights into the key motivations for climate action among Japanese municipalities can offer valuable strategic guidance for increasing political will and mobilizing stakeholders, particularly by shedding light on compelling win-win narratives and synergies with non-climate local priorities. Despite differing development contexts, the motivations of municipalities in Japan may be surprisingly similar to those of cities in developing countries. For instance, the survey shows that economic co-benefits—such as revitalizing local industries and enhancing local energy autonomy—are among the most prominent motivations for municipalities in Japan. As many Japanese regions facing depopulation and industrial hollowing-out seek to revive their local industries and reestablish competitiveness (including through strategies like green growth and the utilization of regional resources) (JICA, 2017), growing cities in developing countries are seeking to establish stable economies that ensure essential public services and affordable energy (ideally, by “leapfrogging” to low-carbon sustainable development (Lwasa et al., 2022)). Similarly, Japan’s acute awareness of disaster risks (historically shaped by frequent experiences of earthquakes and typhoons) echoes the growing climate vulnerabilities faced by many cities worldwide. Finally, the drive to enhance livability and public health through measures such as reducing air pollution, mitigating urban heat islands, and other quality-of-life improvements is likely to be broadly relevant across diverse urban settings. As one municipal official succinctly put it:

I believe it is important, in promoting decarbonization efforts, to approach them with the understanding that they are not about imposing burdens or restrictions, but rather about leading to improvements in daily life and revitalization of the local economy.

In sum, despite inherent contextual differences, the empirical insights from Japan regarding salient local climate action MBEs can be informative and indicative for municipalities in diverse international contexts, although the Japanese contextuality remains a limitation to generalizations.

4.4 Conclusions

Ensuring consistent progress towards cities’ carbon-neutral futures requires understanding of the critical aspects of urban climate governance—specifically, the key motivations that inspire and drive municipalities to pursue net-zero goals, and the key barriers/enablers on their pathway.

To date, however, these critical aspects have not been sufficiently explored. To bridge this gap, I first synthesized an integrated analytical framework of motivations, barriers, and enablers (MBEs) from existing scholarship (see Tables 2.1-2.3 and Figure 2.1), and empirically distilled the most salient factors through a large-scale survey targeting 489 Zero Carbon Cities in Japan. With responses from 309 municipalities, the survey results provide a comprehensive yet focused overview of the key MBEs shaping municipal climate action in Japan, with insights potentially generalizable to similar contexts.

The quantitative results revealed that most committed Japanese municipalities pursuing net zero perceive the opportunities to enhance local economic conditions as their primary motivations. These include improving municipal energy conditions (e.g., increasing energy self-sufficiency and generating local energy revenues), achieving direct financial benefits (from efficiency improvements, increased value-added, etc.), and revitalizing local areas focusing on “green” industry development (thus creating jobs, attracting investment, talent, etc.). Further important motivations include ensuring safety and resilience to disasters and disruptions (e.g., to energy supply), enhancing residents’ quality of life (e.g., cleaner air, less traffic, physically active commute), and boosting the area’s image to attract new residents, businesses, and investors.

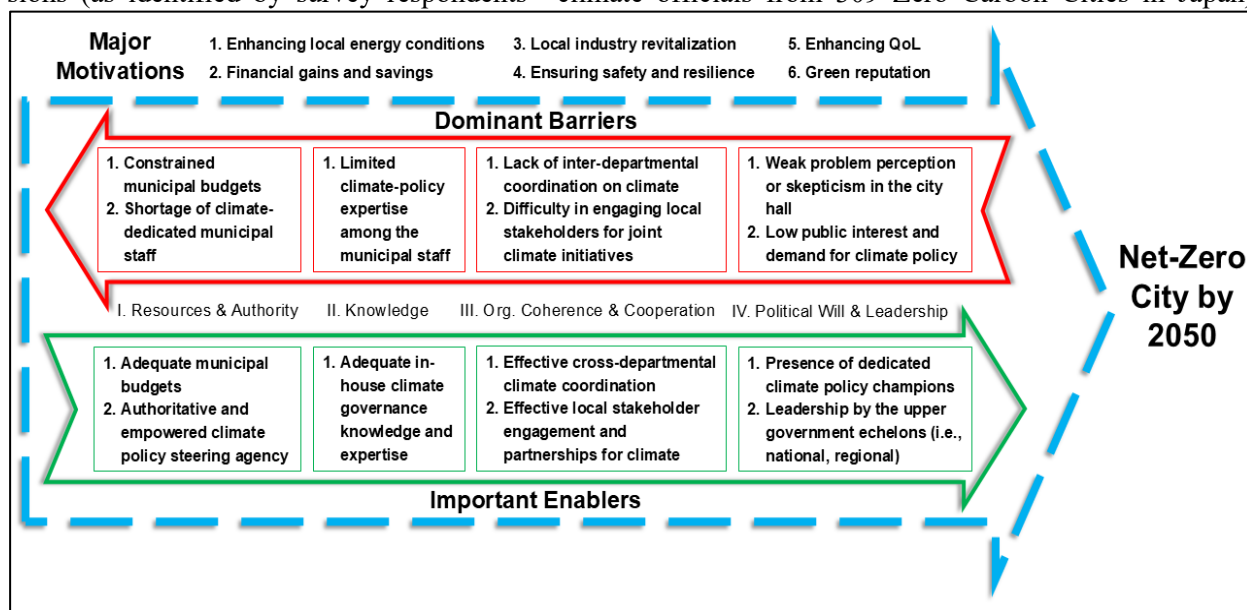
Key barriers and enablers to municipal climate action were ranked across four categories: (I) municipal capacity in terms of resources and authority, where most municipalities highlighted the critical importance of adequate budgets, dedicated staff, and empowered climate agencies; (II) municipal capacity in terms of climate knowledge and expertise, where the necessity for municipal staff to possess specialized climate-policy competencies were emphasized; (III) organizational coherence and cooperation, where the need for effective cross-sectoral coordination and stakeholder engagement were underscored; and (IV) political will and leadership, revealing that skepticism and limited awareness among both city officials and the public present significant challenges, whereas local climate champions and upper-governments’ pro-climate stance constitute top enabling conditions.

These findings are summarized in a conceptual figure providing a bird’s-eye view of the highest-ranked MBEs (Figure 4.10).

The overarching recommendation for both research and policy is to prioritize attention, resources, and efforts toward leveraging and addressing the key MBEs identified through this survey, as they represent high-potential focal points toward more effective local climate action. In this regard, I have outlined the implications and offered my recommendations for targeted interventions in these important areas (see Section 4.3: Discussion and Implications).

The survey study has several limitations. First, although I discuss the general applicability of its findings to other countries (see Section 4.3.3), the exclusive focus on Japan remains an acknowledged limitation for broader generalizations.

Figure 4.10. Municipalities' salient motivations, barriers, and enabling conditions toward net-zero emissions (as identified by survey respondents—climate officials from 309 Zero Carbon Cities in Japan)



Source: author, based on survey results.

Second, the analysis relied exclusively on perspectives of municipal officials responsible for climate policy, potentially differing from views of other local stakeholders. Similarly, assuming these officials' responses fully represent their municipal administrations introduces another limitation. Finally, despite efforts to reduce biases (e.g., through a two-stage survey design), some inherent subjectivity in self-reported, opinion-based surveys remains unavoidable.

Future research may explore specific solutions that address the key barriers, including leveraging interconnections with enablers and motivations. Follow-up studies employing the analytical framework in different geographical contexts or adapting it to other stakeholder groups would further enhance the generalizability of insights and improve the overall understanding of factors influencing local climate action. Additionally, investigating non-committed municipalities could offer insights into alternative perspectives and challenges. Finally, deeper explorations of respondents' and non-respondents' characteristics (e.g., income distribution, political constellations, GHG emission profiles) may uncover meaningful patterns and insights.

In conclusion, while numerous factors shape local climate action, clearly understanding the core motivations, barriers, and enablers behind municipal movement toward net zero is crucial. By providing a holistic framework and empirical insights into the most salient factors identified among 309 committed municipalities in Japan, I hope to facilitate future research and policy that effectively leverage compelling motivations, strategically address critical barriers, and strengthen key enabling conditions.

Chapter 5. Toward Deeper Understanding: A Thematic Analysis of the Qualitative Responses

5.1 Introduction

Chapter 4 presented the quantitative results of the large-scale survey of Japanese municipalities (also published as a journal article), showing how local governments evaluated and prioritized a range of motivations, barriers, and enablers toward achieving net-zero goals (Myasoedov & Ialnazov, 2025). The results, presented through descriptive statistics, provided a systematic mapping of which factors were regarded as most salient, but, by design, they could not reveal *why* officials judged certain issues as especially critical and thereby lacked explanatory depth and context. To address this gap, the present chapter analyzes open-ended responses (textual comments) elicited through the survey.

The research questions that this chapter addresses are as follows: *What themes emerge regarding municipalities' most important motivations, barriers, and enablers towards net-zero? In other words, how do municipalities rationalize and contextualize their most important MBEs? Additionally, do these themes and rationales suggest possible interrelations among various MBEs?*

Mindful of the limitations of a single-method research approach (i.e., only quantitative or only qualitative), the research took a mixed-method approach in both data collection (mixing question design in the survey to yield different types of data) and data analysis (employing both quantitative methods, as described in Chapter 4, and qualitative, as described in this chapter). Indeed, Neuman 2014 outlined the advantages and disadvantages of both closed- and open-ended types of questions in surveys, suggesting downsides can be mitigated by employing a mixed structure (i.e., using both types) (Neuman, 2014, pp. 332–333). Solely closed-ended questions are efficient for yielding structured, quantifiable, and comparable data, while being simpler and quicker to respond to. They enable respondents to provide answers strictly within set boundaries, yielding relevant data that can be statistically aggregated. However, solely closed-ended surveys can also be misleading as they carry inherent limitations. In this survey, this can manifest as the following potential biases.

First, different respondents may have different views on what constitutes “important” when asked to rate items on a scale of 1 to 5. Additionally, as mentioned previously, there is a general tendency in importance evaluation surveys to rate most items as being “important”, thus leading to inflated averages (Van Bennekom, 2017). Furthermore, the wording of questions and the descriptions of questionnaire items, despite being carefully crafted for maximum clarity, can be interpreted differently depending on local conditions and respondents’ backgrounds. Yet any

misunderstandings will not be taken into account in the aggregated statistics, thereby diluting the accuracy of the results.

Another potential limitation is that closed-ended surveys omit the context of responses, so part of the meaning is lost and left to inference. In cases where respondents are not asked to explain their *reasoning*, the researcher must therefore reconstruct *why* certain factors were prioritized, based on hypotheses, models, or prior knowledge (e.g., the researcher's background knowledge or existing literature). This inferential gap risks producing interpretations that diverge from what respondents actually intended to say.

Finally, closed-ended surveys are inevitably constrained by the analytical frameworks that underpin them. Their items are pre-determined, and respondents are required to choose within the strict boundaries of the questions posed—even if they do not fully agree with the premise or the response options offered. Moreover, these frameworks are typically constructed at a higher-abstraction theoretical level, which ensures broad coverage but also produces inherently general and abstract items. This is necessary to ensure every respondent can relate sufficiently to the presented items, yet there is a risk of losing connection with the unique contexts of respondents' settings.

All these limitations also link to the drawbacks of a strictly *positivist* (and *postpositivist*) paradigm to which the quantitative type of research mainly subscribes. As Guba and Lincoln (1994) point out, positivist instruments assume an objective reality that can be measured in isolation, but in doing so, they often strip away the surrounding context that shapes the meaning and relevance of the assessed issue matter (Guba & Lincoln, 1994). In other words, designs that focus narrowly on selected variables may achieve precision, yet they do so by excluding the broader situational factors that give responses their relevance (Guba & Lincoln, 1994). *Interpretive* research takes the opposite view, recognizing that the significance of a response can only be understood within its context. In closed-ended formats, that context is largely lost.

With all of the above in mind, this chapter turns to qualitative research. To situate the survey responses within a richer context, the questionnaire design combined closed-ended items (evaluation and prioritization) with open-ended questions that invited officials to elaborate on their choices. The rationale was that when participants are given the opportunity to explain their selections in their own words, they would clarify the situational factors underlying their judgments and reveal insightful details about the issue. Open-ended responses thus provide insights that extend beyond numerics: they capture the reasoning and perspective of the respondent, thereby “permitting creativity, self-expression, and richness of detail” and “revealing a respondent's logic, thinking process, and frame of reference” (Neuman, 2014, p. 333). To systematize these rich textual descriptions, thematic analysis was applied, allowing individual voices to be preserved while also synthesizing them into broader patterns across the dataset.

With this approach, the resulting data preserve local meaning while still allowing systematic aggregation with qualitative methods (thematic analysis). In this sense, the research approach in this chapter occupies a meso-level position between two opposite extremes: case studies of individual cities, which are rich but overly context-specific, and large-N closed-ended surveys, which are broad but lack explanatory depth. Taking the middle path, the analysis here generated themes that preserve context without being overly place-bound and achieve generality without becoming overly context-detached and abstract.

Moreover, the themes presented in this chapter are not free-floating but anchored in the corresponding existing literature through the analytical framework that structured the survey. The respondents provided open-ended comments following the evaluation and prioritization of MBE items within each category (survey section). These MBE factors and categories were developed through the literature review and synthesis (see Chapter 2). Therefore, the themes that emerged in the data are linked to the corresponding theoretical background through the framework/survey components.

Beyond explaining why municipalities judged certain factors important, the analysis also illuminates how different motivations, barriers, and enablers interrelate. Respondents often described connections both within categories (e.g., between authority and staffing, or between data access and methodological tools) and across them (e.g., economic motivations dominated due to barriers such as constrained fiscal resources; or the enabling quality of leaders seen as offsetting regulatory gaps). These insights resonate with the integrated motivations–barriers–enablers perspective (Myasoedov & Ialnazov, 2025) and provide a basis for the broader synthesis in subsequent chapters.

Unlike the quantitative analysis, which focused on the evaluation scores and ranking frequencies of the “most important MBEs”, the thematic analysis here gives equal consideration to all open-ended responses. This approach allows themes to emerge not only in relation to the most frequently prioritized factors but also around those chosen less often. The rationale is that each open-ended comment was provided in the context of what a municipality considered its single most important issue. Thus, even when a theme appeared in only a few responses, it reflects a meaningful concern that would otherwise be overlooked if attention were confined to statistical majorities. Rather than weakening the analysis, such less common perspectives enrich it by surfacing rationales that would likely be missed in favor of the dominant concerns. In this way, the qualitative findings in Chapter 5 can be read alongside the quantitative results in Chapter 4: they indicate which themes align with the most prioritized factors while also preserving the broader variety of perspectives across the dataset. This avoids bias toward the predictable issues that tend to dominate rankings (e.g., limited budgets or insufficient expertise). More broadly, to paraphrase Lincoln & Guba (2000), it underscores that what counts as “important” should not be equated only

with what is most widely mentioned. Importance can also lie in valuable, nuanced concerns that respondents identify as central to their own municipalities or as unexpected, novel issues that expand and push beyond conventional discussions (Lincoln & Guba, 2000, p. 164)⁹.

Another contribution of this analysis is its responsiveness to participant input. The open-ended responses are treated not merely as raw data for coding but as the voices of municipal officials, offering their perspectives in their own terms. By preserving respondents' words and including various representative quotations that illustrate the themes, the chapter validates these contributions and acknowledges the effort respondents made to articulate their situations. This approach not only enhances the transparency of the findings by helping readers trace the logic behind the themes but also increases the relevance of the results to the audience, who can directly engage with the perspectives and rationales of municipal practitioners.

In sum, this chapter extends the analysis of the survey by moving beyond the statistical rankings of Chapter 4 to examine the reasoning that underpins them and enriching them with insightful contextual details. Through thematic analysis of open-ended responses, the chapter reveals how municipalities themselves explain their choices of motivations, barriers, and enablers, and how these explanations situate familiar issues within local contexts while also bringing forward less common but equally significant concerns. Anchored in the literature-based analytical framework yet attentive to participants' own words, the chapter provides a more rounded account of municipal perspectives on net zero. Taken together, the findings complement the quantitative results with interpretive depth, highlight possible interrelations across categories, and offer insights that are both transparent in origin and relevant for practitioners and researchers alike.

5.2 Methodology

5.2.1 Yielding a Substantial Qualitative Dataset through a Stepwise Survey Design

The analysis in this chapter builds directly on the survey design introduced in Chapter 3: Survey Design and Implementation. As noted earlier, the questionnaire targeted all Japanese municipalities that had made commitments under the Zero Carbon City framework. It was structured in three stages to generate both breadth and depth of responses.

First, respondents evaluated each MBE item on a five-point Likert scale, producing quantitative measures of perceived importance across all factors. Yet rating exercises of this kind often carry the risk that “everything seems important,” as respondents may assign high scores to many items (Van Bennekom, 2017). Therefore, to mitigate this potential bias and to highlight sharper distinctions, as a second stage, respondents were then asked to identify a single most important

⁹ It should be mentioned that Lincoln & Guba's (2000) argument of different understandings of the “importance” was originally mentioned in the context of research paradigms, and not specifically surveys that explore “what is important”. Still, the argument holds regarding this subject matter as well.

factor within each of the survey's nine sections: (1) All Motivations; (2-5) Barriers I–IV; and (6-9) Enablers I–IV. This forced-choice task not only reduced the inflationary tendency of the ratings but also served an additional purpose: it prepared the ground for the subsequent open-ended question. By requiring respondents to weigh all options and commit to a single choice, the exercise mentally conditioned them to reflect more carefully, creating a clear context for explaining their reasoning in their own words. Then, immediately after each forced-choice selection, as the third stage, respondents were invited to provide an optional free-text rationale (comment) for their choice.

In this way, the survey design moved step by step: from a cognitively easy task (rating each factor independently), to a more demanding one (selecting a single most important factor, compromising on others), and finally to the most difficult stage (elaborating in writing). This stepwise structure encouraged and guided respondents' reflection, gradually deepening from one stage to the next. It was intended to elicit richer detail and insight in the open-ended responses by maintaining a consistent framing narrative for each category, while at the same time lowering the threshold for respondents to voluntarily elaborate in their own words. By keeping this final step optional—so that respondents could participate without feeling pressured or overwhelmed—the design nevertheless prompted respondents to engage, yielding a substantial number of open-ended responses.

As a result, the open-ended component generated a considerable qualitative dataset (see Table 5.1). In total, the survey yielded 991 open-ended responses distributed across the nine categories: 153 for motivations, 143 for Barriers Category I (Resources and Authority), 108 for Barriers II (Knowledge and Expertise), 109 for Barriers III (Institutional Coherence), 104 for Barriers IV (Leadership and Political Will), 111 for enablers I (Resources and Authority), 84 for Enablers II (Knowledge and Expertise), 96 for Enablers III (Institutional Coherence), and 83 for Enablers IV (Leadership and Political Will). Combined, these responses amounted to 61,559 characters in Japanese (approximately 60 pages at font size 10) or, when translated into English, 29,918 words (approximately 64 pages at font size 10), with each response as a separate paragraph. Furthermore, each response is very dense in meaning (as respondents directly answer the “Why?” question, justifying a concrete prioritization of factors within a few sentences). Thus, the dataset's size and richness are its major strengths: it provides a large, detailed data pool with sufficient clarity to identify recurring patterns and themes.

Table 5.1. Qualitative response statistic

N	Survey item (based on the analytical framework)	Selections as Number of “single most open-ended important” responses	
Motivations			
1.1	Cost savings and financial benefits	54	21

1.2	Local industry development and economic revitalization (via green growth/circular economy)	61	27
1.3	Improving local energy conditions	57	31
2	Enhancing residents' well-being and health	38	23
3	Strengthening ties and gaining assistance from the national government	2	0
4.1	Green city brand/identity	23	11
4.2	Trend-setting and elevating municipal leadership	11	4
5	Ensuring safety and resilience	50	32
6	Aligning with global norms and contributing to global betterment:	3	3
NA	Don't know, multiple factors apply, or answer outside of the suggested items	8	1
	Total in Motivations	307	153
Barriers Category I: Municipal Capacity: Authority and Resources			
1.1	Limited authority of the municipal climate agency	38	15
1.2	Limited municipal control over key policy areas and infrastructure	17	4
1.3	Inadequate legal and regulatory frameworks	6	2
1.4	Constrained municipal budgets	93	53
1.5	Limited accessibility to funding from external sources	6	4
1.6	High upfront costs of climate measures	52	23
1.7	Lack of climate-dedicated staff within the local administration	66	30
1.8	Lack of access to technological options and specialized workforce in the local area	23	10
NA	Don't know, multiple factors apply, or answer outside of the suggested items	6	2
	Total in Barriers Category I	307	143
Barriers Category II: Municipal Capacity: Knowledge and Expertise			
2.1	Lack of expertise in the administration	180	67
2.2	Limited access to reliable data necessary for policymaking and implementation	15	7
2.3	Lack of methods, tools, or best practices for managing data and creating assessments	90	32
NA	Don't know, multiple factors apply, or answer outside of the suggested items	21	2
	Total in Barriers Category II	306	108
Barriers Category III: Institutional Coherence and Coordination			
3.1	Rigid administrative work culture, climate not incorporated in staff work routines	50	15
3.2	Insufficient inter-departmental cooperation and coordination on climate policy	100	44
3.3	Limited inter-municipal cooperation and coordination of climate response with other peer municipalities	15	2
3.4	Insufficient vertical alignment between national, regional, and local authorities	52	15
3.5	Difficulty in engaging and forming partnerships with local stakeholders	68	30
NA	Don't know, multiple factors apply, or answer outside of the suggested items	21	3
	Total in Barriers Category III	306	109
Barriers Category IV: Political Will and Leadership			
4.1	Lack of local climate policy champions	40	14
4.2	Lack of clear vision, guidance, and leadership by the upper echelons of government	35	12
4.3	Low continuity and priority of climate action on municipal agenda	24	6
4.4	Low public interest, involvement, and demand for climate policy	81	35
4.5	Weak problem perception or skepticism among civil servants	104	33
NA	Don't know, multiple factors apply, or answer outside of the suggested items	23	4
	Total in Barriers Category IV	307	104
Enablers Category I: Municipal Capacity: Authority and Resources			
1.1	Sufficient authority and influence of the dedicated climate agency	49	16
1.2	Sufficient jurisdiction over policy areas and infrastructure that have strong GHG implications (e.g., energy, transport, utilities)	4	0
1.3	Supportive legal context with adequate frameworks in place	17	8
1.4	Adequate municipal budget	108	48
1.5	Accessibility to funding from external sources	8	3
1.6	Synergies with local issues and goals are well explored and exploited	41	15
1.7	Enough staff dedicated to climate in the local administration	40	7
1.8	Local presence/access to low-carbon technology and workforce	27	12
NA	Don't know, multiple factors apply, or answer outside of the suggested items	12	2
	Total in Enablers Category I	306	111

Enablers Category II: Municipal Capacity: Knowledge and Expertise			
2.1	Adequate municipal staff climate governance expertise	137	31
2.2	Access to reliable and locally relevant data	80	33
2.3	access to technical instruments (e.g., tools, methods, and know-how)	62	18
NA	Don't know, multiple factors apply, or answer outside of the suggested items	26	2
Total in Enablers Category II		305	84
Enablers Category III: Institutional Coherence and Coordination			
3.1	Climate embedded in the organizational culture and staff is stimulated	31	9
3.2	Effective cross-department coordination on climate among the administration agencies	111	34
3.3	Strong horizontal cooperation with peer municipalities, including membership in city networks	13	4
3.4	Strong vertical alignment between national, regional, and local authorities	50	9
3.5	Sufficient partnerships and involvement of stakeholders	85	39
NA	Don't know, multiple factors apply, or answer outside of the suggested items	16	1
Total in Enablers Category III		306	96
Enablers Category IV: Political Will and Leadership			
4.1	Dedicated local climate policy champions	122	38
4.2	Strong vision and leadership by the upper echelons of government	68	18
4.3	Continuity and favorability toward environmental action on the local agenda	29	5
4.4	Citizens exhibiting high interest and demand for climate policy	64	20
NA	Don't know, multiple factors apply, or answer outside of the suggested items	24	2
Total in Enablers Category IV		307	83
Total Overall		-	991

Source: created by the author

5.2.2 Qualitative Analysis Process

The analysis followed the principles of thematic analysis—the systematic identification, analysis, and reporting of patterns within qualitative data (Braun & Clarke, 2006). At the same time, the coding process was guided by the grounded-theory inductive procedures of *open*, *axial*, and *selective coding* associated with Strauss (1987), as summarized in Neuman (2014) in respect to methodological recommendations for “qualitative data coding” (Neuman, 2014, pp. 480–485).

Following Strauss's (1987) methodology, the *open-coding stage* was conducted first. Firstly, all responses were first translated from Japanese into English.¹⁰ Coding was conducted on the English translations, while the Japanese originals were read in parallel to ensure that each code faithfully captured the intended meaning. Figure 5.1 shows a fragment of the process in which open codes were created from the original textual responses using the computer software for qualitative data analysis, MAXQDA (version 2024).

Responses were coded with short, sentence-like labels that preserved the central idea of each statement. For example, a response emphasizing that financial incentives are indispensable for securing cooperation from private stakeholders was coded as “Financial merit as incentive for stakeholder support and implementation.”

¹⁰ While the translation was machine-assisted, the careful treatment of each response throughout the whole qualitative coding process (i.e., repeated re-reading, cross-check with the Japanese original, and coding the data) ensures the accurate understanding of the original material.

Figure 5.1. A fragment of the coding process

This is because, when looking ahead to reconstruction after the Nankai Trough earthquake that will occur in the near future, an environment where electricity can be used seems to be the most effective for maintaining the lives of residents, and it is easy for residents to understand the necessity (concrete image).	- MC V: Vulnerability - M: Expecting rising disasters risk - M: Expecting earthquakes - M: Autonomous/self-sufficient distributed energy to hedge disruptions due to disasters	近い将来に発生する南海トラフ地震の発災後の復興を見据えた時、電気が使用できる環境は住民の生活の維持に一番効果的であると思われる
This is because we have experienced flooding caused by the collapse of the Kinu River due to the occurrence of heavy rains in the Kanto and Tohoku regions in September 2015, flooding one-third of the city's area and causing enormous damage to citizens' lives and local industries.	- MC V: Vulnerability - M: experience of disaster - M: Shock from past disaster resulted in high awareness (of disaster risk and CC) - M: experienced heavy rains; floods	平成27年9月の関東・東北豪雨の発生による鬼怒川の決壊に伴う洪水に見舞われ、市面積の1/3が浸水し、市民生活・地域産業に甚大な
This is because the aim is to solve the global warming problem, which is a common global issue, and to preserve the living environment of residents.	- MC V: Vulnerability - M: Realizing the city's responsibility to address CC as its own issue - M: As part of the city's vision for future - M: Solving global issue while ensuring resident's safety	世界共通の課題である地球温暖化問題を解決し、住民の生活環境を保全していくことが目的であるため。
This is because ensuring the safety of residents is also important in climate policy.	- MC V: Vulnerability - M: As part of adaptation	気候政策においても住民の安全確保が重要であるため。
The entire city is a remote island, its electrical system is independent of the mainland, and it relies on fossil fuels imported from the mainland for power generation in the city. For this reason, if the distribution line is divided for a long time due to a disaster or the like, there is a risk that the power supply will be interrupted. It is important to spread distributed energy infrastructure by introducing renewable energy and other means, and to reduce the risk in the event of such a disaster.	- MC V: Vulnerability - M: Autonomous/self-sufficient distributed energy to hedge disruptions due to disasters	当市は全域が離島であり、電気系統が本土から独立しているほか、市内での発電についても本土から移入する化石燃料に依存している。この
The city's Basic Environmental Plan states that in order to convey to the future a blessed and rich environment in which humans and nature coexist, we will work toward net zero carbon dioxide emissions.	- MC V: Vulnerability - M: As part of the city's vision for future - M: To pass rich nature to future gen	当市の環境基本計画では、人間と自然との共生の下で恵み豊かな環境を将来に伝えるために、二酸化炭素排出量実質ゼロに向けて取り組むこ
The city is a municipality facing the sea, and because it affects the rise in sea level due to global warming and the catch of seafood.	- MC V: Vulnerability - M: Expecting rising disasters risk - M: expecting rising sea levels - M: expecting/experiencing CC impacts on fish catch	本市は海に面した自治体であり、地球温暖化による海面上昇や海産物の漁獲高への影響を与えるため
The characteristics of the city include that 30% of the city area is at zero meters above sea level and that drainage is constantly carried out, and that it is a rural city where more than 50% of the city is occupied by fields. The risk of flood damage due to climate change is large, and the yield and quality of paddy rice have already deteriorated due to high temperatures, and adaptation is being pressed.	- MC V: Vulnerability - M: Expecting rising disasters risk - M: City's low altitude - a recognized acute risk factor - M: Expecting floods - M: Protecting against heat-island - M: As part of adaptation - M: experiencing reduced crop yields due to heat	本市の特徴として、市域の3割が海抜ゼロメートル地帯であり常時排水を行っていること、また5割以上を田畑が占める田園型都市であるこ

Note: A fragment shows how some of the open-ended responses explaining why respondents selected “ensuring safety” as their most important motivation were coded into “open codes”. The left column shows verbatim quotes (English translations), the middle column the assigned codes, and the right column the original Japanese text for cross-checking. Abbreviations used: MC V– Motivation Category Five (Ensuring Safety); M – Motivations; CC – Climate Change; CA – Climate Action; LG – Local Government. Source: Author; Software: MAXQDA 2024.

Often, open codes were kept fairly detailed so as not to lose important context and insight during subsequent steps toward theme synthesis. This approach aligns with recommended practice in thematic analysis (Braun & Clarke, 2006) and with Boyatzis's view that "a good thematic code is one that captures the qualitative richness of the phenomenon" (Boyatzis, 1998, as quoted in Neuman, 2014, p. 482). Figure 5.2 displays a fragment of the resulting code structure created during the open-coding stage.

Figure 5.2. A fragment of the resulting structure of the open-codes

OE6. 設問: (№ 1.1 ~ № 1.8)から選んだ最も重要な推進要因の理由	111
OE6. Why selected enabler important? - Cat.1 (eng)	111
▼ E1(1.1): Capable climate agency is essential	16
E1(1.1): capable climate agency with sufficient specialized staff	5
E1(1.1): capable climate agency with high enthusiasm essential for effective impl-n	2
E1(1.1): capable climate agency while coop-n between dep-s is smooth	4
E1(1.1): capable climate agency where staff possess relevant specialized knowledge	3
E1(1.1): capable climate agency where staff rotation isn't hampering knowledge accumulation	2
▼ E1(1.3): Supportive frameworks in place	8
E1(1.3): Legal binding (i.e., basis for the necessity to act) is essential	4
E1(1.3): Legal framework that clarifies responsibilities	1
E1(1.3): Supportive framework with nat./pref gov-s providing supervision/guidance/best practice	2
E1(1.3): What LGs can do limited, so nationwide framework necessary to promote CA	1
▼ E1(1.4): Adequate municipal budget	48
E1(1.4): Budget necessary to establish priority	3
E1(1.4): Budget necessary to promote RE and other capital plants/equipment	8
E1(1.4): Incentives (subsidies) to private sector necessary to motivate to undertake initiatives	2
E1(1.4): Adq. budgets will allow subsidizing projects by citizens/businesses	3
▼ E1(1.4): Adequate budget is necessary but currently constrained	9
E1(1.4): Adq. budget necessary but was affected by coronavirus	1
E1(1.4): Adq. budgets necessary esp from Nat. Gov. (subsidies) since local budgets insufficient	9
E1(1.4): Budget necessary to hire staff and establish the CA governance system in LG	2
E1(1.4): Adeq. budget makes impl-n possible (but with no budget there is no implementation)	11
E1(1.4): Adq. budget necessary but local decline leads to lower tax revenues	1
E1(1.4): Nationwide action supported by adq. finance is necessary (LGs alone are limited)	2
▼ E1(1.4): Adequate budgets necessary to overcome upfront costs	3
E1(1.4): preliminary surveys to start project (e.g., RE) are costly	1
E1(1.4): Adq. budget necessary for decision-making within LG	2
E1(1.4): Projects with not much fin. burden desirable	1
E1(1.4): Fin. subsidies not only to pioneering but other regions necessary	1
E1(1.4): Necessary budgets will follow when residents' support will be gained due to heightened awareness of CC	1
E1(1.4): Attracting investment from outside of the region through high env. brand	1
E1(1.4): Adequate budgets necessary but, existing nat. subsidies are too cumbersome or insufficient	2
E1(1.4): National fund for CA should be established	1
E1(1.4): Flexible subsidies support local CA	1
▼ E1(1.5): External funding	3
E1(1.5): When LG is limited in knowledge & staff, external consultancy possible if funds available	1
E1(1.5): Enhanced subsidy system from nat./pref gov-s will promote CA	1
E1(1.5): Nat. gov. subsidies should be blanket types, not point as they are now	1

Note: The figure shows a fragment of the code system created in MAXQDA 2024 from open-ended responses. Numbers on the right indicate code frequencies. Parent codes correspond to factors in the analytical framework, i.e., the questionnaire items selected by respondents as the "single most important" within this category. Source: Author.

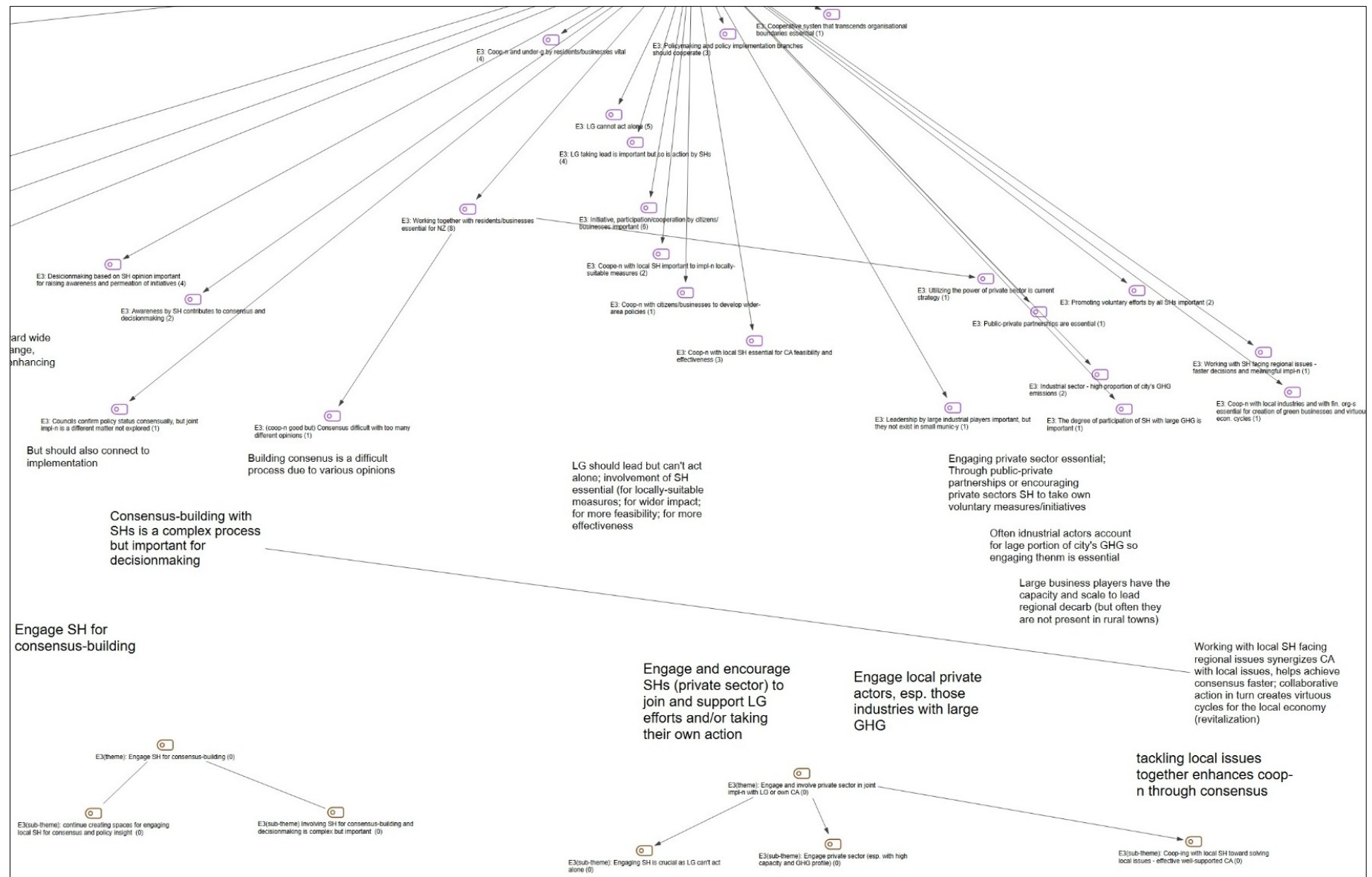
The open-codes were created after reading the response and condensing its meaning into a compact idea. Open-codes differed in their granularity depending on the response. In some cases, a unique, relatively detailed code was made and attached to just one response. At other times, a simpler (more general) code was created that could be attached to multiple responses. Open-codes served a purpose as initial codes to be later compared, grouped, and synthesized into higher-level abstractions—themes.

Further, following Strauss (1987), in the *axial coding stage*, these descriptive open codes were iteratively compared, grouped, and arranged into clusters that reflected relationships among them (Neuman, 2014, pp. 480–485). MAXQDA’s “Creative Coding” and “MAXMaps” tools were used to visualize connections, annotate clusters, and explore how codes related to one another. Open codes with similar and related meanings were placed near each other on a large blank canvas (in the “MAXMaps” tool), thus creating clusters of meanings. Arrows were used to connect inter-related codes. Where appropriate, annotative comments were made, usually summarizing the codes within the cluster, to support theme synthesis. Figure 5.3 displays a fragment of the axial coding process.

Finally, in Strauss's (1987) *selective coding stage*, these clusters were synthesized into higher-order themes that captured the central rationales respondents articulated for their choices of particular factors. For instance, several codes relating to financial incentives, implementation feasibility, and cost reduction were integrated into a theme on “*Economic incentives as a prerequisite for implementation.*”

While the above code-to-theme process, based on Strauss (1987), is anchored in grounded theory principles, it is also consistent with Braun and Clarke’s (2006) *six phases of thematic analysis* (Braun & Clarke, 2006). (1) *Familiarization with the data* was achieved through repeated reading (of both English and Japanese texts). (2) *Initial codes* were generated in a “data-driven” (as opposed to “theory-driven”) fashion through open coding, letting the initial codes arise inductively directly from the data. (3) *Searching for themes* occurred during axial clustering, which “refocuses the analysis at the broader level of themes, rather than codes” and “involves sorting the different codes into potential themes”, with the help of “visual representations” (i.e., as depicted on Figure 5.3) (Braun & Clarke, 2006). (4) *Reviewing* phase aligned with the selective coding stage and corresponded to iterative refinement of themes against the raw responses. (5) *Defining and naming themes* occurred in the process of systematizing and organizing the resulting themes into summary tables, which outline themes’ names, descriptions/components, and illustrative excerpt quotes (see Results section). Final (6) *producing the report* phase corresponded to the write-up of the analysis outcomes (see the structured list of themes below in the Results, and the narrative overview further in the Discussion sections).

Figure 5.3. A fragment displaying the process of axial coding and synthesis of themes



Note: Purple tags show open codes from responses to Enabler N3.5 “Stakeholder Involvement,” with numbers in brackets indicating coding frequency. Text boxes highlight notable patterns and clusters of related codes. Brown tags represent the synthesized themes and their sub-themes (i.e., theme components).

Importantly, the themes are not treated as sub-categories of the original survey factors, but as conceptual condensations of respondents’ reasoning and themes in their own right. The open-ended codes were initially anchored in the factor that respondents had identified as “single most important” (Q2: prioritization question), capturing how they articulated that factor’s significance in their own context. However, during the axial coding stage, codes from different factors within a category were compared and clustered by shared meaning, producing themes that cut across individual items and contexts. In this way, the themes represent synthesized patterns of reasoning rather than simple restatements of the survey questions—an approach that avoids the pitfall identified by Braun and Clarke (2006), where thematic analysis studies sometimes report “themes” that simply restate original questions posed to respondents (Braun & Clarke, 2006).

Furthermore, throughout the thematic analysis process—from the creation of initial codes to the generation, refinement, and write-up of themes—numerous cross-factor linkages became apparent. Officials explicitly (or implicitly but in ways that were easily deducible) connected their chosen factor—the context in which their comment was provided—to other MBEs. For example, insufficient expertise (B2.1) was frequently linked to staff shortages (B1.7), while financial gains as a motivation (M1.1) were associated with budget constraints (B1.4) and the need for consensus-building (B3.2; B3.5). These linkages were particularly valuable because they pointed to relationships that would be difficult to detect through quantitative measures (e.g., correlation analysis) alone. In this way, they not only informed theme development but also enriched understanding of how motivations, barriers, and enablers interact within the overall framework.

To ensure rigor and transparency, the analysis was designed to satisfy four trustworthiness criteria for qualitative inquiry. According to Lincoln and Guba’s (1985) framework, the qualitative trustworthiness criteria (their approximate corresponding quantitative counterparts shown in brackets) are as follows: *credibility* (internal validity/truth value), *transferability* (external validity/generalizability), *dependability* (consistency/replicability), and *confirmability* (researcher’s objectivity/neutrality) (Lincoln & Guba, 1985).

Credibility was pursued by remaining faithful to respondents’ accounts through persistent engagement with both Japanese originals and English translations, systematic coding, and iterative refinement of themes against the raw quotations. Equal consideration was given to all data—not only to the most frequently reported issues but also to less common perspectives—reflecting a broader interpretation of importance and avoiding bias toward the statistical majority. In line with Lincoln and Guba’s (1985) emphasis on prolonged engagement and persistent observation, the

author's long-term academic base in Japan, immersion in the study of Japanese local governance, and certified command of the Japanese language further enhanced credibility by ensuring cultural sensitivity and linguistic accuracy in interpreting responses. *Transferability* was supported by providing “thick” enough descriptions of each theme (within the constraints of space when reporting, as well as the original brevity of given responses). Each theme was explicitly anchored in the literature-derived analytical framework, ensuring a theoretical grounding. Furthermore, an unusually large sample for a qualitative inquiry (309 municipalities) further enhanced the scope for transferability. *Dependability* was ensured through the systematic use of specialized software (MAXQDA), which created a transparent audit trail that included open codes, clustered codes, summary notes, visual representations (e.g., mind maps), and preserved original data. *Confirmability* was supported by grounding interpretations in participants' own words rather than researcher assumptions: themes were generated inductively and data-driven, with illustrative quotations reported for each theme to preserve the authenticity of municipal officials' voices. At the same time, the researcher's interpretive role in constructing meaning, consistent with a constructivist approach, is explicitly acknowledged, with careful design and reflexivity used to minimize bias.

5.3 Results

The original dataset (overviewed in Section 5.2.1) was coded into more than 500 open codes through the thematic analysis process described in Section 5.2.2. These codes were subsequently clustered into 66 themes. Table 5.2 summarizes this process, showing the distribution of open codes and resulting themes across the three major survey dimensions: (1) Motivations, (2) Barriers, and (3) Enablers.

Table 5.2. Qualitative coding statistic

Response context			Coding outcomes	
Survey section	Survey items	Category	No. of open codes	No. of themes synthesized
Motivations				
M	M1.1–M1.3	Local Economic Development	72	12
	M2	Quality of Life	16	5
	M3	Institutional	0	0
	M4.1–M4.2	Political/Cultural	19	4
	M5	Perceiving Vulnerability/ Ensuring Safety	30	3
	M6	Global Norms, Altruism	9	2
Total in Motivations Section			146	26
Barriers				
B1	B1.1–B1.8	Municipal Capacity: Authority and Resources	39	5
B2	B2.1–B2.3	Municipal Capacity: Knowledge and Expertise	27	2
B3	B3.1–B3.5	Institutional Coherence and Coordination	39	4
B4	B4.1–B4.5	Political Will and Leadership	27	5
Total in Barriers (Sections B1-B4)			132	16
Enablers				
E1	E1.1–E1.8	Municipal Capacity: Authority and Resources	53	5
E2	E2.1–E2.3	Municipal Capacity: Knowledge and Expertise	56	4
E3	E3.1–E3.5	Institutional Coherence and Coordination	67	6
E4	E4.1–E4.4	Political Will and Leadership	70	9

Total in Enablers (Sections E1-E4)	246	24
------------------------------------	-----	----

Source: Created by the author.

This section presents the results of the thematic analysis in the form of three summary tables: (1) Motivations (Table 5.3), (2) Barriers (Table 5.4), and (3) Enablers (Table 5.5). Each table displays the synthesized themes alongside their descriptive components, the framework's parent item (together with any related factors), and the representative quotes from qualitative responses. Related factors were included based on a combination of criteria: whether the correlation with the parent factor exceeded 0.3 (see Chapter 4) and whether the relationship was explicitly or implicitly indicated in the qualitative responses. In this way, themes are connected to the original analytical framework described in Chapter 2.

The tables provide a bird's-eye view of the thematic analysis, as reproducing the full corpus of qualitative evidence is not feasible given its size. The tables distill the qualitative material into essential rationales (themes), supported by representative components and illustrative quotations. Mind maps from the axial coding stage that show how open codes were grouped into higher-level categories and themes, as well as full transcripts and MAXQDA project files documenting all coding and synthesis steps are available from the author upon request. Access to raw survey response data will be carefully vetted by the author to ensure it is used solely for academic research.¹¹

¹¹ This is to comply with the informed consent agreement reached between the author and the respondents. See Appendix A, page 1 (in Japanese).

Table 5.3. Motivation themes (MT-1–MT-26) identified through thematic analysis of open-ended responses, with representative components and quotes

The me code	Motivations theme	Major (and related) framework items ¹	Description / Components	Representative quotes (translated from Japanese)
MT-1	The presence of financial benefits and incentives is crucial for gaining stakeholder support for climate policy (therefore, the financial advantages of climate action serve as a major motivation)	M1.1 (BE3.2; BE3.5)	Financial benefits from climate action serve as incentives for: • stakeholders to support and implement measures • increasing the likelihood and effectiveness of implementation	• <i>In order to implement measures to realize a zero-carbon city, we believe that incentives such as cost reduction are important. Without incentives, measures are unlikely to be implemented.</i> • <i>Since the department in charge of climate in this city is not a cross-sectional organization, it is necessary to seek the cooperation of others (departments, etc.), and we believe that it is effective to negotiate using financial merits as a material.</i>
MT-2	The current fiscal constraints of municipalities make the financial benefits of climate action their focus and a major motivation.	M1.1 (M1.2; BE1.4)	Being a resource-constrained municipality determines its focus on financial benefits.	• <i>Because the financial constraints of the town are severe</i> • <i>[T]he city cannot afford to promote measures that do not have tangible benefits for citizens. Therefore, although there is a background that ‘ensuring safety’ and ‘taking initiatives from an ethical point of view’ are important, they have not become major motivations. ..., so we think that the motivation to work on zero-carbon measures at present is centered on financial merits.</i>
MT-3	Above all, financial gains take precedence over other considerations	M1.1	• For a variety of reasons (stated and unstated), financial gains simply take precedence over all other considerations (motivations). • In some cases, municipalities are already net-zero (e.g., those with large proportions of forested areas), hence their focus is on reaping the financial benefits of various climate measures (including through cooperation with other municipalities on joint projects)	• <i>At the local government level, other factors are important but weak as motivation on their own.</i> • <i>At present, forests occupy more than 90% of the town's land area, and in terms of CO2 emissions, zero carbon has already been achieved. Therefore, while we believe that securing financial benefits by improving energy-saving efficiency is important for the time being in advancing the plan, we are equally important in implementing measures to achieve zero carbon by integrating the six towns that jointly declared themselves zero-carbon cities.</i>
MT-4	Cost-avoidance via green upgrades	M1.1	Avoiding the costs of aging and inefficient infrastructure/equipment through timely ‘green’ upgrades	• <i>The aging of public facilities has increased the cost of repair, demolition, rebuilding, etc., which is putting pressure on the budgets of local governments. It is necessary to reduce running costs by introducing high-efficiency systems and equipment even if only slightly.</i>
MT-5	Net Zero provides an opportunity to reverse regional decline and encourage revitalization, all while aligning with global climate mitigation efforts.	M1.2 (M1.1; M1.3; M2; M3; M4.1)	• Realizing that climate action, although aimed at a global issue, can also help solve many local problems. • Regional decline—driven by depopulation, industrial hollowing, high energy costs, and other issues—has created a vicious cycle of stagnation.	• <i>Putting the brakes on population decline, the declining birthrate and aging population, and the stagnation of the local economy is a major issue, and urban development with an eye on a new era is an urgent task. By improving the attractiveness and convenience of local communities and revitalizing the economy through decarbonization initiatives, it is necessary to realize a sustainable town...</i>

			Climate action is viewed as a way to break this cycle by promoting green industries that generate jobs, keep revenues within the local area, boost attractiveness, and potentially reverse population decline, turning the cycle into a virtuous one.	• <i>Efforts toward decarbonization should not be seen as imposing burdens or restrictions, but rather as initiatives that lead to improvements in daily life and revitalization of the local economy. It seems important to proceed with this understanding.</i> • <i>Decarbonization is a major shift in the social and industrial structure, and it has become a field in which countries around the world invest funds and generate strong growth. This is because it will be an opportunity to attract people, create employment, and generate revenue even in regional cities.</i> • <i>[W]e hope that the implementation of the Zero Carbon City Policy being promoted by the national government this time will contribute not only to measures against global warming but also to the resolution of regional issues.</i>
MT-6	Revitalization via climate action—a "plan" that engages and incentivizes stakeholders toward implementation, cooperation, and consensus toward net-zero	M1.2 (BE3.2; BE3.5)	Revitalizing the local economy through climate action serves as a unifying goal, which: • incentivizes and encourages the private sector and residents to participate • helps build consensus and promote cooperation among a wide range of stakeholders	• <i>Since zero carbon cannot be achieved through the efforts of the government alone, the key to achieving this goal is how to involve local residents and companies. In order to improve the motivation of the region, it is necessary to have a plan that will be a big plus for the development of the local economy.</i> • <i>[H]ighlighting the aspect of regional economic development would be very useful in building consensus necessary for advancing climate measures.</i>
MT-7	Leveraging local strengths and introducing innovative initiatives as practical ways to revitalize the community via climate action	M1.2 (M1.3; E3.5; E3.3)	Among the ways to achieve revitalization in synergy with climate action are: • utilizing unique local resources (for energy generation and other development purposes) • establishing innovative public-private partnerships (e.g., municipal utility companies) and initiatives	• <i>To create new industries and jobs using local resources and renewable energy, thereby contributing to regional revitalization. (This includes utilizing region-specific resources such as forest resources, groundwater, and small-scale hydropower.)</i> • <i>[W]e have established a new regional power company together with neighboring municipalities and private businesses, and we are creating a town centered on renewable energy.</i>
MT-8	Climate action diversifies and enhances the city's socio-economic activity and resident services	M1.2 (M2)	Ultimately, measures toward net-zero will lead to improved city services, achieving decarbonization without reduction of socio-economic activities, and help recover from pandemic-induced decline (i.e., green recovery)	• <i>[I]n order to build a sustainable society, we will not assume a reduction in social and economic activities, but by actively promoting initiatives to realize a decarbonized society, sustainable economic development, and affluent civic life, we aim to simultaneously realize the preservation of the global environment.</i> • <i>It is said that economic recovery from the pandemic should not simply mean a return to our previous ways of life. This is because doing so would put the world on a path toward a temperature increase of more than 3°C. For this reason, the concept of a green recovery is considered essential.</i>
MT-9	Promoting renewable energy fosters regional economic growth and creates virtuous cycles, where local projects generate	M1.3	Promote local energy businesses to create a positive economic cycle that circulates revenue within the region. Measures include 'local production local consumption' schemes through municipal electric power	• <i>In order to carry out sustainable activities, we believe that the economic cycle through local production and local consumption of energy is important.</i> • <i>Energy costs that have previously flowed out of the city due to the use of fossil fuels can be expected to circulate within the region through the</i>

	profits that benefit the community		initiatives, cooperation with neighboring municipalities on waste-to-energy projects, and more.	<i>introduction of renewable energy, utilization of unused energy, and job creation related to their maintenance and management.</i> • <i>In the city, the potential of RE other than solar power generation is low, and it is difficult to create energy. Under these circumstances, there are garbage treatment facilities jointly operated in five surrounding cities and one town, and we believe that it will be very useful to utilize the waste generated power generation in the community. There is a limit to the measures taken by a single municipality, and "local production and local consumption of energy" is the most important theme for multiple municipalities to jointly develop measures.</i>
MT-10	Increasing local autonomy (e.g., energy self-sufficiency, fiscal stability) in synergy with climate action through local resource use and the promotion of renewable energy	M1.3 (M1.2; M5; E1.4; E3.5)	In synergy with measures toward net-zero, enhance local autonomy by utilizing local resources, such as developing local renewable energy sources, resulting in: • Increased disaster resilience due to decentralized, autonomous local energy • Improved energy security through stable supply and price stability • Strengthened fiscal stability by localizing energy, reducing energy purchase costs, and creating local revenue sources	• <i>We believe that achieving energy self-sufficiency will lead to the creation of disaster-resilient communities and the protection of the economy by not relying on energy derived from fossil fuels, which are expected to soar in the future.</i> • <i>In 2018, the city signed the Pledge of the World Emirates/Japan Secretariat and announced the measures toward RE100. Thus, the city promotes local production and local consumption of energy (100% of the city's energy demand covered by RE produced locally) and aims for economic circulation within the region through such efforts...</i> • <i>The city established the electricity retail company ... to realize local production and local consumption of energy. Since energy-related expenditures are large when surveying the regional economy, in order to improve the sustainability of the city, the city needs energy sources (power sources), and at least in terms of life cycle costs, we would like to create an independent area.</i>
MT-11	Climate action can help address concerns about the municipality's fiscal stress, including costs related to energy expenditures.	M1.3 (B1.4; M1.1)	Having been concerned about the limited fiscal situation in the city (where energy expenses for fossil fuels contribute to the problem), net-zero is viewed as a way to improve this unfavorable situation.	• <i>The outflow of energy bills in the local economy has become a weakness for the region. In order to solve this problem ... it is extremely necessary to locally produce and consume energy locally.</i> • <i>In implementing clerical work, since it is important for local governments to take the lead in reducing carbon dioxide emissions as a business operator and to bring about maximum cost-effectiveness within the limited budget range, we believe that it is necessary to consider business effects (reduction of energy consumption and associated cost reduction).</i>
MT-12	Enhance stakeholder collaboration and awareness through local energy projects	M1.3 (BE3.5; BE4.4)	Utilizing local RE potential will foster cooperation among stakeholders, while enhancing climate awareness and overall residents' satisfaction	• <i>By strengthening initiatives related to renewable energy by taking advantage of the high potential for the introduction of solar energy compared to other regions, we believe that it will lead to the fostering of environmental awareness and the improvement of resident satisfaction by creating new regional attractiveness and participation in measures by local residents and companies.</i> • <i>In order to realize a zero-carbon city in this city, it is essential to introduce renewable energy that takes advantage of regional characteristics (blessed sunshine conditions), and it is necessary for citizens, businesses, and the government to work together to promote it.</i>

Residents' livability and welfare are central to local government operations (i.e., LG's raison d'être).	M2	• Climate action aligns with the primary goal of local governments to enhance city services and residents' well-being. • Improving residents' livability/QoL is a fundamental principle enshrined in the city's key decrees (e.g., Basic Environmental Ordinance).	• <i>The primary purpose of local governments is to enhance the welfare of residents. Especially in regions facing challenges such as declining birthrates, aging populations, and economic decline, improving the livability for residents is recognized as a crucial aspect of promoting their welfare.</i> • <i>As the administration closest to residents, we believe that it is an important task to improve the livability of residents.</i>
Through climate action, the city can tackle various negative impacts (such as climate-related health hazards or harmful side effects of economic growth) and improve residents' health, well-being, and happiness.	M2 (E1.6)	• Climate action aimed at enhancing health, well-being, and QoL can reduce the negative externalities of economic growth (e.g., traffic, air pollution) • Net-zero strategies may synergistically contribute to the mitigation of climate-induced health risks, such as urban heat islands, for example, through the development of increased green spaces within cities. • It is recognized that climate action is not about imposing burdens, but can contribute to residents' quality of life, including by creating conducive conditions for lifestyle and behavior change among citizens. • Climate action is acknowledged for its contribution to the health and well-being of residents, enhancing living conditions and consequently supporting mental health.	• <i>Not only from an environmental perspective but also through improving residents' welfare, citizen satisfaction can be enhanced.</i> • <i>[T]here are many large-scale shopping centers and stores moving in. This has led to an increase in traffic jams. In addition, development is progressing, and green spaces are also decreasing. In order to solve these problems, we believe that it is necessary to work on a zero-carbon city and promote urban development that is easy for residents to live in.</i> • <i>For the city, which is an urbanized area in its entirety, it is important to work on mitigating the heat island phenomenon.</i> • <i>Efforts toward decarbonization are not about imposing sacrifices but about improving residents' quality of life through lifestyle changes.</i> • <i>The City has declared itself a "Healthy City" prior to the Zero Carbon City Declaration, and the Comprehensive Plan also sets forth its vision for the future, aiming to create "a city where people can have a sense of purpose in life, be healthy and happy." Therefore, we believe that it is of the utmost importance to contribute to the "Healthy and Happy City" through the development of decarbonization measures.</i> • <i>It can be expected that measures against global warming will make it easier for citizens to live, and thereby create mental space.</i>
The potential of climate action to enhance community attractiveness through improved livability, thereby addressing major social issues, such as depopulation and regional decline.	M2 (M1.3; E1.6)	In synergy with climate action, the city can boost its appeal for living and settling by improving local livability, health, the environment, and creating new economic opportunities, which can help reduce resident outflow and attract newcomers settlers.	• <i>The ease of living of residents is an item that leads to in-migration and settlement, and it was judged to be particularly important.</i> • <i>Not only environmentally-related, but also social issues such as population decline can be solved automatically.</i>
Climate action, synergistic with the enhancement of local livability and quality of life, may result in increased awareness and engagement of residents.	M2 (BE3.5; BE4.4)	By linking climate action to QoL and health benefits, it may be possible to boost resident awareness and build stronger support for climate policy. The "livability" and "health" benefit arguments used in climate communication with residents can lead to more active civic engagement, ultimately driving lifestyle changes. As a result, greater participation in low-carbon	• <i>This is because decarbonization efforts do not force patience, but improve the quality of life of residents through lifestyle changes.</i> • <i>Towards becoming a zero-carbon city, our city places importance on raising environmental awareness among citizens and promoting citizen autonomy and initiative through community collaboration. Aiming to "improve livability for residents" through climate measures is believed to lead to increased environmental awareness.</i>

			lifestyles will contribute both to more effective climate action and to improved health.	
MT-17	Passing on a healthy and livable town to future generations	M2 (E4.3)	Climate action, along with its community co-benefits and synergies, ultimately contributes to the development of a genuinely sustainable town for future generations.	• The realization of a zero-carbon city is a goal, and the true purpose is to pass on a green, nature-rich, and environmentally friendly city to the next generation. • The city's Basic Environmental Ordinance stipulates that "we will maintain a good environment in which all citizens can lead safe, healthy, and comfortable cultural lives, and pass them on to future generations,"
MT-18	Live up to responsibilities given the city's carbon footprint and capabilities	M4.1 (M4.2; E3.5)	• Responsibility as an industrial city with significant emissions • Presence of local environmental industries and technologies	• [X] City has a high concentration of environmental technologies and industries, and together with environmentally conscious citizens and businesses, possesses significant potential to lead climate change initiatives. In addition to serving as a major supply base for energy and products contributing to Japanese industry, [X] City also has the highest greenhouse gas emissions among ordinance-designated cities. As a "SDGs Future City" aiming to build a sustainable society, [X] City has a responsibility to address climate change issues sincerely. • Since many companies are located mainly in coastal areas, the city is characterized by high greenhouse gas emissions in the industrial sector compared to the national and prefectural governments, so it is important to take the initiative in decarbonizing efforts.
MT-19	Encourage stakeholders by fostering increased civic pride stemming from the city's environmental leadership and brand, supported by the city's proactive history or visionary policy commitments	M4.1 (M4.2; BE3.5; BE4.4)	• Fostering civic pride, thus motivating stakeholders toward action and building a strong bottom-up support base for the city's policies. • Uphold the town's announced policies, commitments, and visions for its future (e.g., SDGs Future City, etc.) • Uphold the city's established brand based on its history of action. • Hosting a rich natural environment, including World Heritage Sites.	• As a [city hosting a natural] World Heritage Site, the city has a responsibility to maintain a high level of environmental awareness in the future, and we believe that this will lead to the pride of its citizens. • To foster civic pride by becoming a local government that contributes to the world. • As a leading environmental city, it is an important motivation to maintain and further enhance the image of the city, which has been focusing on environmental conservation measures such as subsidizing the installation of solar panels from an early stage.
MT-20	Boost local appeal through environmental efforts, resulting in community revitalization	M4.1 (M1.2)	• Foster and enhance the city's brand power • Promote local revitalization through environmental initiatives, including hosting pioneering technology demonstration projects.	• We want to improve the brand power of the city. • The population has been declining..., and we would like to attract new residents by improving the environmental attractiveness and evaluation of the area. • [Our town] is a remote island... with a population of about 7,600 people, experiencing a population decline of about 100 people every year. [Our town] has the largest deep-sea water pumping facility in Japan, and is conducting demonstration research on ocean temperature difference power generation. ... [W]e believe that expanding deep-sea water-related industries will lead to solutions to problems such as population decline.

MT-21	Recognizing the responsibility of local governments to raise awareness and lead by example.	M4.2 (BE3.5; BE4.4)	- Local government leading by example - Fostering climate awareness through municipal pioneering action and climate communication	<i>In order for the city, citizens, and businesses to work together to realize a decarbonized society, we believe it is important for local governments to take the lead in formulating climate measures and to communicate their importance.</i>
MT-22	Ensuring the safety of residents is the primary responsibility of the government and constitutes a highly locally relevant objective	M5	- Climate action to ensure the safety of residents is a paramount responsibility of the local government. - Local safety is a higher priority, in contrast to action for the sake of more abstract objectives, such as global contribution or following global trends and standards	<i>In [X] City, the essence of the Zero Carbon Declaration is to protect citizens from the negative impact of environmental changes caused by climate change on citizens' lives.</i> <i>As a small local municipality, it is considered more important to prioritize the safety and security of current residents over external factors such as other cities or overseas.</i>
MT-23	Climate action as a way to safeguard communities—connecting decarbonization with disaster risk reduction, livelihood protection, and increased resilience	M5 (M1.3; M2; E1.6)	- Past experiences of occurring disasters resulted in the community's high awareness of its vulnerabilities and hence the desire to safeguard residents from future tragedies - Although no disasters have previously occurred, the municipality perceives risks of disasters in the near future - Already experiencing negative climate impacts on local livelihoods (e.g., warming ocean impacts fish catch, abnormal heat impacts crop yields) - Existing climate mitigation solutions are seen as promising for increasing safety and resilience (e.g., decentralized renewable energy to boost energy security and independence, ensuring stable electricity and water supply during disaster-related power outages; nature-based solutions and green spaces to protect against flash floods and reduce urban heat island effects).	<i>The first-class river Yamato River flows through the area, and the town has long suffered from flood damage and other disasters. In addition, past disasters have forced residents to endure extremely stressful evacuation life under power outages. For this reason, the town has been highly motivated to implement projects such as installing solar power systems and storage batteries on the roofs of public facilities, so that electricity supply will not be interrupted during disasters.</i> <i>This city faces the sea, and global warming is expected to cause sea level rise and affect the catch of marine products.</i> <i>A distinctive feature of this city is that 30% of its area lies in zones at zero meters above sea level, requiring constant drainage, and more than half of the area is occupied by rice fields and farmland, making it an agrarian-type city. The risk of flooding due to climate change is significant, and declines in both the yield and quality of rice caused by high temperatures are already occurring, placing the city in a situation where adaptation is imperative.</i> <i>The city has long suffered extensive damage from major disasters. By promoting decarbonization, such as through the introduction of renewable energy, the city believes it can not only move closer to achieving a "Zero Carbon City," but also protect residents' lives by addressing global warming and adapting to climate change. For this reason, we consider this item to be particularly important.</i>
MT-24	Safety rationale as a strong link to heightened awareness	M5 (BE3.5; BE4.4)	- Responding to a high level of resident awareness and policy demands for increased disaster resilience - Raising awareness of climate impacts and hazards to motivate stakeholders to take independent action.	<i>Because our town has also been damaged by the intensifying disasters, and the interest of residents in the disasters is also high.</i> <i>Because the awareness of natural disasters is also highest from the townspeople's questionnaire</i> <i>We believe that it is important for residents and businesses to recognize the risks posed by global warming and to respond to them as their own thing.</i>
MT-25	Local responsibility and leadership toward global efforts	M6 (M4.2)	Given that the environment is fundamental to all aspects of life, municipalities bear a responsibility to undertake measures for environmental protection.	<i>The environment is the foundation of the economy and society, and in order to make current life sustainable, it is necessary to achieve carbon neutrality. Municipalities should emphasize their commitment to the international community and take the lead in carbon neutrality efforts.</i>

			Recognizing the municipality's role as part of the international community highlights the importance of local leadership and global contribution.
MT- 26	From global awareness to local action	M6 (BE4.4)	Municipal governments must catch important signals (information) globally, notify residents, and plan local responses accordingly [We were] inspired by the IPCC reports on climate change and the [national] government's Zero Carbon Declaration. Not only the administration but also private companies and citizens are now paying attention to future developments, which has raised awareness of global warming. For this reason, this factor is considered highly important.... [A]s a local government, we aim to accurately keep up with changing information and educate our citizens, thereby advancing our efforts step by step.

Notes: ¹ *Major items* refer to the questionnaire choices respondents identified as the “single most important” in each category, which provided the context for their open-ended explanations. These items are part of the analytical framework developed from the literature (see Chapter 2, Tables 2.1-2.3). *Related items* are those explicitly or implicitly mentioned in responses and showing correlations above $r > 0.3$ (see Chapter 4 for correlation analysis results). Codes “M,” “B,” and “E” denote Motivations, Barriers, and Enablers respectively (“BE” indicates both Barriers and Enablers). Source: Created by the author.

Table 5.4. Barrier themes (BT-1–BT-17) synthesized from open-ended survey responses, with representative components and quotes

The me code	Barriers theme	Major (and related) framework items ¹	Description / Components	Representative quotes
BT-1	Financial support from the national/prefectural government is required	B1.4 (B1.5; B1.6; B1.7)	- Implementing climate action by local governments requires additional funding, meaning extra resources beyond the current budgets that are already allocated for essential city services - Current subsidy schemes by the national/prefectural government are insufficient, inflexible, and overly complicated	- Advancing decarbonization requires significant costs, and the city is struggling with how to secure the necessary funding. Although the national government offers multiple subsidy programs, competition is intense, and they are not easy to utilize. - Given the current budget situation, it seems that even with subsidies, it would be difficult to make ends meet. [Decarbonization projects] are extremely costly, making it difficult to carry them out with only the town's budget. In the past, we have utilized subsidies to install solar panels and storage batteries, but such subsidies have been provided in a “point-based” manner rather than on an “area-wide” basis.
BT-2	Costs are high, and benefits (such as revenues and cleaner energy) are distant, which discourages enthusiasm for action among both the local government and stakeholders	B1.6 (B1.4; B1.5; B3.5; B3.2; B4.3)	- Due to high initial costs and limited budgets, priority is given to short-term and cost-effective initiatives - Reaching a consensus is difficult because of the high costs of measures, and their results and benefits often seem too distant to justify the spending - Climate action by private residents and businesses remains low because of high costs	- The main reason for the lack of internal and external funding is the high initial costs. - If activities to achieve net-zero CO2 emissions could generate profit, then it would be possible to realize net zero even without government involvement. However, since the costs are high and investment recovery is difficult, it is necessary to provide subsidies to individuals or businesses within a sustainable scope in order to encourage efforts toward net zero.

			<i>Yet, because municipalities lack the financial resources to do this, support from the national government is essential.</i> • <i>We believe that the high cost is a major obstacle to reaching a consensus on global warming countermeasures.</i>
BT-3	The lack of dedicated staff in administration hampers climate action	B1.7 / B1.1 (B1.1; B2.1; B3.2)	• Too many tasks for the environmental department alone; staff are overstretched • The total number of staff in the administration is limited, which makes it hard to assign staff solely to decarbonization objectives • Limited capacity of the responsible department (due to staff and time shortages) hampers internal consensus within the administration. • <i>Because there are few staff members and they also have to handle other duties concurrently, we are unable to respond adequately</i> • <i>Since climate change issues are large-scale problems involving many different sectors, what a local government department in charge can actually do is considered to be very limited</i> • <i>To achieve decarbonization, policies from all angles are needed, and a cross-sectional department is necessary. However, because each department has its own regular work, there are not enough personnel. In addition, the total number of employees is decreasing, making it difficult to immediately increase the number of staff in the decarbonization department.</i>
BT-4	Private sector action is necessary but challenging for various reasons (e.g., lack of local workforce)	B1.8 (B1.3; B1.7; B2.1; B3.2; B3.5)	• Implementing projects by local stakeholders is crucial, but there is a shortage of needed human resources within both the administration and the city • Encouraging independent action by private actors is challenging without proper penalties or incentives • <i>The efforts of each business operator are indispensable for the decarbonization of the city area, but it seems that SMEs in particular have not been able to make efforts to decarbonize due to a shortage of human resources.</i> • <i>In order to circulate energy within the region and promote it continuously as an economic activity, it is necessary to develop human resources. * There are few such human resources in rural areas.</i> • <i>I believe that unless regulations are imposed to some extent, measures against global warming will not progress.</i>
BT-5	Other priorities take precedence over local climate action for various reasons	(various) (B1.4, B1.5, B1.6, B1.7)	• Priority low due to high costs, limited budgets, personnel, staff time, difficulty in reaching consensus, lack of stakeholder interest, etc. • <i>In addition to the fact that climate change countermeasures are not a high priority in local governments, it is difficult to secure budgets and personnel</i> • <i>In this city, decarbonization is not among the highest priorities among social issues, and because the costs of implementation are high, there is a shortage of budget.</i> • <i>Although national subsidy programs exist, none cover 100%, and under the difficult fiscal situation, decarbonization measures end up being a lower priority for the use of general funds.</i>
BT-6	Climate action requires a high level of specialized knowledge and expertise, which the administration—including city employees and senior	B2.1 (B1.7; B3.1; B3.2; B4.5)	• Lack of environmental professionals among the local administration staff hinders climate action • Translating information to citizens and, vice versa, incorporating local knowledge into policy is lacking • Expertise is necessary to identify and evaluate co-benefits/merits and prepare the evidence base for policymaking, but such expertise is lacking • <i>In addition to the chronic shortage of personnel, there is no knowledge or know-how, and it is difficult to develop effective initiatives.</i> • <i>Without the expertise of policymakers, it is impossible to judge what policies are more effective.</i> • <i>Although it is possible to prepare a plan through outsourcing [to external consultancy], it is undesirable that, due to the lack of expertise on the part of municipal planners, the measures end up being exactly as proposed by the contractors. In order to implement optimal measures that</i>

decision-makers—currently lacks	• City employees are generalists, and because of the personnel rotation system—where staff is transferred between departments every few years—they do not develop the specialized expertise needed for climate policy planning and implementation. • Because the local administration lacks in-house climate expertise, work is often outsourced to external consultants. However, without sufficient internal expertise, actions based on externally prepared plans do not fully account for local characteristics, leading to inefficiencies. Additionally, external consultants, who require extra spending, are hired on a project basis for a limited time, so they do not help build knowledge within the local administration. • Top management (decision-makers) lack understanding or are unresponsive, providing insufficient input, which stifles staff efforts <i>take into account the characteristics and conditions of each municipality, local government planners must acquire solid specialized knowledge before participating in policymaking</i> • <i>[S]pecialized knowledge is required not only about local characteristics but also about global trends and the latest technological developments. However, since staff are rotated every few years in local governments, expertise is limited, and we must rely on external experts.</i> • <i>Acquiring expertise is time-consuming and costly. At the same time, local government employees undergo personnel transfers every few years, so it is quite difficult to pass on organizational knowledge.</i> • <i>Current decarbonization measures remain simplistic and image-driven, and it is undeniable that there is a lack of skills for policy planning that fully leverages regional characteristics or for building projects with assured long-term viability.</i> • <i>We are struggling because we lack the knowledge no matter what we try to do.</i> • <i>The city's top management [decisionmakers] ..., do not fully understand the scale of policies required. ... [T]he response of the top management, who are supposed to mobilize all staff, has been insufficient.... As a result, despite the time spent by staff, there has been virtually no progress in climate change countermeasures.</i>
Acquiring and understanding raw primary data is complex, while proxy data estimates used presently are approximate and problematic BT-7 B2.2 / B2.3 (B2.1; B3.4; B3.5)	• Currently, estimates of local GHG inventories are rough, aggregated, and cannot be linked to policy evidence. This is because they rely on proxy data (i.e., top-down estimates derived by dividing national or prefectural totals), which means the effects of local policies cannot be estimated as they are not reflected in such data. • Continuous collection of locally relevant and up-to-date statistical data is essential for accurate estimations and evidence-based policymaking. The current local data estimates are based on aggregated national or prefecture data, which results in a significant time lag. • Obtaining primary (raw) data directly from local entities (e.g., industries, SMEs) is restricted and complex. Furthermore, data coordination with regional utilities (e.g., electric power companies) is necessary. • <i>Apart from the top-down apportioning of national and prefectural data, there is no method for calculating data that reflects the actual conditions of the city in order to verify the effectiveness of initiatives.</i> • <i>Grasping GHG emissions in the region is important when considering measures. On the other hand, the statistical data presented by the government was released two or three years later, and the results of the measures at this point in time cannot be sufficiently verified.</i> • <i>It is difficult to keep track of emissions data from companies in the industrial and manufacturing sectors.</i> • <i>It is not possible to fully grasp factors such as electricity consumption in the residential/commercial sector or the status of renewable energy facility installations.</i> • <i>When calculating the city's GHG emissions, we have not been able to obtain cooperation from electricity retailers, so we are unable to calculate accurate figures and the data varies from year to year.</i> • <i>There is no nationwide standardized basis for calculating CO2 emissions (it does not align with the Ministry of the Environment's municipal "karute" records).</i>

		• Available methodologies are fragmented and too complicated	
BT-8	The current organizational system in the administration falls short of facilitating a unified agency-wide effort for effective climate policy planning	B3.1 / B3.2 (B1.1; B1.4; B1.7; B2.1; B3.5; B4.5) • On one hand, the environment-focused staff is insufficient, overstretched, or lacks climate-related expertise. On the other hand, other departments refuse to take on extra work that is not directly within their scope or may even oppose climate policy because it diverts resources like budgets and labor. • A lack of understanding of how actions toward net-zero relate to other departments hampers consensus and cooperation. • There is a lack of a unified vision and an agency-wide coordination system for climate issues within the administration. A more effective organizational structure is needed to support agency-wide climate policy planning, but currently, the work is conducted in silo.	• <i>Because each department does not understand how its own duties are related to climate change countermeasures, there seems to be a perception that it would simply increase their administrative workload, and thus, I feel they are not very cooperative.</i> • <i>Although the city has declared its aim to achieve carbon neutrality by 2050, at present, it does not have an organization that can address climate change issues across the entire municipal administration. Before even looking for [engaging] stakeholders such as citizens or local businesses, the city lacks an organization dedicated to climate change, so internal coordination is necessary first.</i> • <i>With insufficient staffing in the Environmental Division itself, isolation caused by siloed administration [“tatewari gyousei”] is considered an obstacle to promoting climate policy.</i> • <i>Because staff are overwhelmed with daily duties, few of them wish to take on new projects. They tend to think, “it’s not my job.”</i> • <i>Since contributing to zero carbon spans a wide range of areas, it is important to take a cross-sectoral approach to climate policies in each field. To begin with, in order to promote efforts across the entire organization, it is necessary to raise awareness and enhance issue recognition among each individual staff member.</i> • <i>Although there is recognition that “environmental considerations” are important, incorporating them into the work of each responsible division ultimately entails costs. While we need to balance “economic efficiency” with “environmental considerations,” under the current fiscal circumstances, the municipality is compelled to prioritize “economic efficiency.” Unless there are clear benefits—such as allocating budgets preferentially to projects that incorporate environmental considerations—it is difficult to gain understanding and cooperation from each division. In this sense, the environmental department is isolated.</i>
BT-9	Regional cooperation with peer municipalities is necessary to address policy areas where single municipal jurisdiction is limited (e.g., regional energy management, infrastructure), and to facilitate joint subsidy applications	B3.3 (B1.2) • Certain policies and initiatives require broader jurisdictions (e.g., regional energy management) and coordination with neighboring municipalities. • Certain grants and subsidies require collective application by multiple municipalities working together on a regional project, which involves coordination and consensus-building with peer municipalities	• <i>At present, I feel that many municipalities are pursuing measures on their own, but ... these measures are likely to hit a ceiling. I sense the necessity of conducting energy management on a broader regional scale over the medium to long term, and therefore believe that close cooperation with the prefecture and neighboring municipalities will be essential going forward.</i> • <i>Because it [municipality] is a remote island, it is not flexible in energy procurement.</i>

BT-10	Weak vertical alignment between country, regional, and local levels, along with limited input from higher governments, restricts local climate action	B3.4 (B1.3; B1.4/B1.5; B1.6; B1.7; B4.2)	• A disconnect and lack of shared vision among national, prefectural, and local governments lead to fragmented and poorly integrated climate action. • A stronger role by national and prefecture governments is needed to support local governments in implementing climate solutions with fewer burdens (such as high initial costs, lack of guidelines, insufficient expertise, and absence of regional cooperative networks led by prefectures) • The current system in place at a higher level of government is highly unsatisfactory for various reasons: (1) incentives in place favor high-capacity municipalities, leaving smaller ones behind; (2) local governments left to their own devices are acting in silo and confined to largely symbolic measures with limited scope and impact; (3) insufficient cooperation by prefectural governments limits wider collaboration between municipalities within the region; (4) a one-size-fits-all national vision overlooks the unique regional conditions	• <i>Environmental measures should be tackled with a vision shared within the country, but the national government, prefectures, and municipalities have a gap in their perceptions of the regions that actually undertake them, and the direction is not uniform.</i> • <i>Many basic municipalities are struggling with financial shortages, making it difficult to implement measures such as converting public facilities to ZEBs [Net-Zero Energy Buildings]. Even if there are long-term benefits through learning cost reductions, large initial costs make implementation difficult. Therefore, we hope that the national government will actively take fiscal measures to reduce initial costs and, with strong authority, guide and lead municipalities.</i> • <i>[S]ubsidies and regulations remain limited to favoring existing vested interests, meaning that under the current situation, only municipalities with sufficient staff and financial resources are able to work on decarbonization.</i> • <i>If decarbonization is considered solely at the local level, there is a possibility of falling into suboptimal solutions rather than achieving holistic optimization.</i> • <i>Since climate policies require wide-ranging measures, there are limits to what a municipality can do on its own. Therefore, I believe it is necessary to build a system that enables cooperation among municipalities within the prefecture, with the prefecture playing a central role.</i> • <i>The vision presented by the national government is one-size-fits-all and does not seem to take into account the unique circumstances of each region</i>
BT-11	Consensus with and engagement of local stakeholders is essential but hard to attain	B3.5	• Fostering involvement and independent action by the private sector (residents/businesses) is important. Specifically, in terms of both: (1) encouraging residents toward voluntary/independent action and behavior change; (2) ensuring the participation of large emission-intensive industrial players is critical. • Currently, existing mechanisms for stakeholder engagement and consensus-building are inadequate.	• <i>Since each stakeholder has a different direction and areas of expertise, it is necessary to unite them and move in the same direction.</i> • <i>In order to achieve zero carbon, it is essential to expand residents' voluntary initiatives.</i> • <i>There is a lack of measures to encourage reductions in the industrial sector, which accounts for 80% of emissions.</i> • <i>Since decarbonization of local communities is expected to generate burdens, it is expected that it will be difficult to gain the understanding and cooperation of stakeholders.</i>
BT-12	Decisive top-down leadership by municipal leaders is essential but currently missing	B4.1 (B3.1; B3.2; B2.2; B2.3; B4.3; B4.4; B4.5)	• The political influence of top leaders and their top-down decision-making power is necessary to: (1) break down silos and gridlock, fostering a stronger consensus and unified whole-of-administration direction for climate action;	• <i>Given the current weakness of horizontal linkages and the need to change the mindset so that each department recognizes its own responsibility to act, I believe that top-down decision-making is the quickest and most reliable way to ensure implementation.</i> • <i>Because the effects [of climate action] are not readily visible and can only be understood by tracking long-term changes in the data, there are</i>

		(2) provide more support and weight to policy decisions despite incomplete evidence (such as insufficient data or partial assessments) and the high costs associated with measures. • More proactive leadership from municipal leaders is essential to establish a stronger climate policy promotion system and raise awareness both inside and outside the municipal government.	<i>limits to a bottom-up approach ... with organization-wide understanding and cooperation amid unclear evidence.</i> • <i>[S]ince it will take a considerable amount of money and time, I think that the leadership of the mayor is necessary for the city to advance policies unitedly.</i> • <i>To advance [climate action], it is necessary to strengthen cross-departmental collaboration and build momentum both within and beyond the city. Therefore, ... a certain degree of top-down direction and statements of intent from municipal leaders are needed; however, such leadership has been unstable due to political and economic conditions.</i>
BT-13	The guiding/advisory role of national and prefectural governments is currently inadequate and highly unsatisfactory B4.2 (B2.1; B3.4;	• Beyond issuing subsidies, national and prefectural governments provide very limited consultation or advisory support to municipalities: (1) guidance is scarce, support is weak, and there is currently no consultation window/forum where municipalities can bring up specific issues; (2) prefectures rarely offer advice or guidance on climate action, and prefectural staff appear to lack the necessary expertise. • Low-capacity municipalities in particular feel left out under such circumstances, resulting in growing disparities between stronger and weaker local governments.	• <i>There is a sense that the national and prefectural governments have more or less dumped the responsibility on us, and we are proceeding by trial and error</i> • <i>We feel that there are almost no occasions on which the prefecture coordinates or provides advice on climate change issues, which does not help cultivate a sense of urgency or recognition of the issue's importance. (It may also be that prefectural officials themselves lack sufficient expertise)</i> • <i>Because there is no forum within [higher] government agencies for concrete consultation.</i> • <i>Our primary interaction with the national and prefectural governments is the receipt of subsidies, and we have rarely felt any oversight or guidance in advancing policies. Consequently, disparities are beginning to emerge between municipalities that move forward on their own and those that do not, which we believe is one factor hindering broader regional collaboration.</i>
BT-14	The strategic leadership and proactive political direction from top-tier governments are lacking B4.2 (B3.3)	• National and prefectural governments should take a more proactive role in developing broader strategic policies (including technology development and funding allocation). • Prefectural leadership is lacking for coordinating wide-region action among local governments within the region.	• <i>We believe that funds and technology are indispensable for energy measures, and that they should be developed strategically and efficiently under the leadership of the national and prefectural governments.</i> • <i>Municipalities within the prefecture need to work together under the leadership of political leaders. As a result, disparities are emerging in the progress of municipalities' climate policies.</i> • <i>[T]his is a challenge that should be addressed on a wide-area basis rather than by each municipality alone, it ought to be advanced with strong leadership as a national policy.</i>
BT-15	There is limited agreement on the importance of climate action on municipal agendas (net-zero is not seen as an urgent issue, synergies are not well-developed, etc.). B4.3 (B4.1; B4.2; B4.4)	• Prioritizing climate action, a long-term goal with distant effects, is challenging to integrate into local agendas. This difficulty primarily stems from: (1) the focus on immediate, daily policies, (2) the lack of clear identification and communication of co-benefits and synergies to stakeholders,	• <i>Compared to problems related to daily life (welfare, road repair, education, etc.), it is difficult for residents to feel the effects of zero carbon and climate change countermeasures. In a citizen survey, while environmental issues were considered "important," the results showed that "priority" was low.</i> • <i>In departments other than the environmental division, it is hard to envision the benefits. Even within environment-related divisions, we are unable to explain co-benefits beyond the cost aspect.</i>

			including other government divisions, hindering consensus and policy support, and (3) the need to raise awareness and willingness to act among actors, which can be supported through grants and by developing a long-term vision for 2040/50)	
BT-16	Low understanding, concern, and willingness of residents to take action are problematic	B4.4 (B3.5; B4.1; B4.3; B4.5)	- Widespread belief that climate action is someone else's responsibility (residents believe it's the government's job, while the government thinks the private sector should lead initiatives) - Encouraging independent action and widespread participation by civil society (i.e., behavior and life-style change) is essential, yet awareness alone is often insufficient or does not lead to action	<i>It seems that not only residents but also businesses, politicians, and government at all levels... regard it as somebody else's problem.</i> <i>[Resident] demand for measures against global warming is currently low. If residents' demand were to increase, I believe politicians would reconsider their stance, but we have not reached that point yet.</i> <i>Although there are a certain number of citizens who are interested in environmental issues, the challenge is that they have not translated that interest into concrete action.</i> <i>I believe that efforts to reduce CO₂ emissions in the civil sector—especially in households—are important. In everyday life, the changes caused by global warming are extremely subtle, and to be honest, it is hard to feel how it will affect our future. Under such day-to-day circumstances, a sense of crisis is slow to develop, leading people to indifference.</i>
BT-17	A greater awareness across the entire municipal administration is necessary	B4.5 (B1.1; B3.2; B4.4)	- Lack of awareness hampers inter-departmental cooperation and coordination on climate, preventing the adoption of a whole-of-government approach to climate action - The responsible department should take more initiative and raise awareness - Other departments handle different issues, so climate action is not considered their priority or responsibility.	<i>While the low level of citizen interest is a serious issue, I believe it is even more serious that municipal employees—who should be taking the lead—have a weak sense of the problem. Since the responsible department can do little on its own, cooperation from other departments is extremely important, but at present we are not obtaining it.</i> <i>I feel that awareness is still insufficient that the entire municipal government should advance decarbonization measures together. As with other policy issues, I believe the department in charge needs to conduct outreach to convey that climate change is a priority that should be addressed proactively.</i> <i>It's not that every department lacks awareness of climate change issues, but there are various other circumstances and challenges besides climate change, making it difficult to prioritize it.</i>

Notes: ¹ *Major items* refer to the questionnaire choices respondents identified as the “single most important” in each category, which provided the context for their open-ended explanations. These items are part of the analytical framework developed from the literature (see Chapter 2, Tables 2.1-2.3). *Related items* are those explicitly or implicitly mentioned in responses and showing correlations above $r > 0.3$ (see Chapter 4 for correlation analysis results). Codes “M,” “B,” and “E” denote Motivations, Barriers, and Enablers respectively (“BE” indicates both Barriers and Enablers). Source: Created by author.

Table 5.5. Enabler themes (ET-1–ET-24) synthesized from open-ended survey responses, with representative components and quotes

The me code	Enabler theme	Major (and related) framework items ¹	Description / Components	Representative quotes
ET-1	An enhanced organizational structure that coordinates climate policy, supported by enough specialized staff, contributes to better climate policy planning	E1.1 / E1.7 (E1.4; E1.5; E1.8; E2.1; E2.2; E2.3; E3.1; E3.2; E4.1)	- Expanded organizational structure necessary for climate policy (including an empowered agency in charge) strengthens institutional cooperation and advances consensus-building - An empowered organizational structure is enabled, among other factors, by: (1) having enough staff who are motivated and possess adequate expertise (2) having suitable organizational structures (e.g., workgroups, etc.) that enable climate policy planning (3) having sufficient budgets needed for securing expert human resources	<i>By expanding the organizational structure of environmental policy, it is possible to strengthen cooperation with other departments and promote it comprehensively.</i> <i>If talented personnel who can take on regional leadership roles are secured, it is believed that it will be easier to gain consensus on policies implemented by local governments, allowing plans to proceed smoothly.</i> <i>Climate policy involves a wide range of fields, so it is necessary to set up a project teams and allocate sufficient personnel with a wide range of specialized knowledge.</i> <i>Unless there are sufficient personnel, it is not possible to proceed with a sense of speed</i> <i>[T]he shortage of personnel in the department in charge seems to be due to the lack of budget.</i>
ET-2	Robust national support frameworks define responsibilities, provide a clear basis for action, and encourage broader participation, helping to go beyond the limited actions that local government can achieve alone	E1.3 (B1.3; E3.4; E4.2)	- Legal framework clarifies responsibilities and basis for action - Legal framework enforces action - National supporting framework helps overcome limitations of local governments and enables wider action	<i>It is necessary to introduce a framework for legally regulating GHG as soon as possible, and to clarify the responsibilities to emitters.</i> <i>Even if sufficient funding were secured, [climate mitigation measures] do not yield visible results for a long time, so personnel and budgets are unlikely to be allocated. Therefore, binding measures—such as making them mandatory—are necessary.</i> <i>Since there are limits to what can be carried out by a single municipality—or even by several working together—promoting adequate [climate action] requires a nationwide framework commensurate with that scale.</i>
ET-3	Adequate financial incentives, flexible subsidies, and sufficient municipal budgets enable local action	E1.4 / E1.5 (B1.4; B1.5; BE1.7; BE2.1; BE3.5)	- Local government faces fiscal limits and must sustain essential services; thus, additional funds are needed for climate action. - Climate action requires significant upfront investment (e.g., energy-saving or RE power generation facilities) - Financial incentives (subsidies) needed to spur private sector action (e.g., by residents and local businesses) - A flexible subsidy scheme is necessary	<i>Because we believe that it is important to promote the project in a way that does not place as much financial burden on the city as possible.</i> <i>Energy-saving facilities and renewable energy power generation facilities have economic advantages in the long run, but since the initial cost is large, preferential treatment to support their introduction is necessary.</i> <i>Private investment is indispensable for achieving decarbonization, not to mention the financial resources of local governments, but the absence of subsidies to the private sector will greatly affect the motivation of the private sector.</i> <i>[I]t is not something that small municipalities can solve with their own financial resources, and subsidies from the national government are essential.</i>

Active participation from the private sector can provide essential resources and energy to local climate efforts, as well as help spread broader impacts (especially considering the limitations faced by local governments alone)	E1.8 (BE1.2; BE1.4; BE1.7; BE2.1; E3.5)	• Growing awareness and involvement from the private sector (businesses and residents) could unlock more funding and investments for local climate initiatives • Private sector involvement enables broader dissemination, considering the limitations of local governments alone	• <i>[I]t will be important to enhance the subsidy system of the national and prefectural governments.</i> • <i>[D]ecarbonization cannot be established even if only the government actively promotes it. If there are human resources who can become core leaders of decarbonization measures in the private sector, it will be a great boost for decarbonization of the entire region.</i> • <i>There are several factories in the city operated by companies that are leaders in decarbonization, and we expect them to serve as key anchors of public-private collaboration. However, at present there are cases where initiatives are limited to efforts undertaken by corporate headquarters located in other regions; if those efforts were to spread company-wide, we could expect effective contributions within our city as well.</i>
Climate action proposals should include clear and persuasive benefits for the local community beyond mitigation, aiding in building consensus	E1.6 (B1.1; B1.4; B1.7)	• To overcome local limitations (given constrained budgets and labor) and offset initial costs, the potential of climate action to contribute to local issues and benefit communities must be exploited • To overcome the responsible agency's limited authority and build a whole-of-government consensus on climate action, establishing synergies is essential	• <i>I believe that the measures to combat the issue of global warming can be promoted by linking and synergizing with other projects, leading to solutions to various issues</i> • <i>Because achieving carbon neutrality cannot be accomplished by the responsible department alone, we believe it is necessary to link efforts not only to climate-change countermeasures but also to sustainable community development, and to pursue them across the entire municipal organization.</i>
Having sufficient staff with climate expertise across both dedicated and other departments supports evidence-based policymaking and the recognition of synergies, which helps improve consensus and policy outcomes	E2.1 (E1.6; E2.2; E3.1; E3.3)	• Adequate expertise allows for identifying policy synergies, creating a foundation for consensus and coordinated action • Policymakers need sufficient expertise to make appropriate and effective decisions • While outsourcing can offer support, in-house expertise is essential to ensure policies reflect the local context • Climate should be integrated into other key municipal functions (such as tax, welfare, etc.) to promote more effective action and a balanced, whole-of-administration approach	• <i>Given the limited budget and personnel, the fact that synergies can be expected is highly important.</i> • <i>In order to effectively implement measures that understand the characteristics of the region, it is quite important to acquire specialized knowledge.</i> • <i>I think this should be positioned as one of the municipality's core functions—like taxation and social welfare—and pursued accordingly.</i> • <i>I believe that it is particularly important for local governments to have the expertise to determine which initiatives are necessary and effective.</i> • <i>Although it is possible to prepare a plan through outsourcing [to external consultancy], it is undesirable... To implement optimal measures that take into account the characteristics and conditions of each municipality, local government planners must acquire solid specialized knowledge before participating in policymaking</i>
Simplifying data collection and providing direct access to relevant, actual data—accurately reflecting local conditions and organized in a centralized	E2.2 (E2.3; E3.1; E3.4; E3.5)	• Data collection and access should be straightforward and not overly difficult • Making primary data (i.e., data reflecting activities of various actors and sectors within the local area) more open and accessible to local governments.	• <i>Since collecting baseline data is essential for climate countermeasures, data collection should be kept as simple as possible.</i> • <i>If it becomes possible to grasp the CO2 emissions and energy consumption of companies in the city, etc., it will lead to the consideration of more effective initiatives in line with the actual situation of the city.</i>

information hub—reduces the workload for local governments and supports effective policy planning		• A mechanism is required to collect reliable primary data from local actors and sectors • A centralized system that organizes knowledge and offers access to relevant, trustworthy information through a user-friendly data hub	• <i>Although a wide range of information is provided by the national and prefectural governments as well as the private sector, it is difficult to extract what is necessary for our city. We therefore hope for the development of an information-access network (system).</i>
A precise understanding of the local situation based on ongoing and actual data supports policymaking and gaining policy support	E2.2 (E2.3; E3.5)	• Credible local data, which is actual (non-proxy) and continuous (time-series), and presented in a visual and engaging way, forms the foundation for realistic action plans and garnering stakeholder support. • Methods of assessing the municipality's GHG inventory must improve	• <i>By continuously tracking the emissions of the various actors in the area and by easily obtaining the data needed to properly evaluate the effectiveness of implemented climate measures, we believe we can put this to use in planning and policy design.</i> • <i>If it becomes possible to grasp the CO2 emissions and energy consumption of companies in the city, etc., it will lead to the consideration of more effective initiatives in line with the actual situation of the city.</i> • <i>When asking citizens and companies for cooperation in decarbonization efforts, it is important to visualize the numerical basis and effects of issues and goals, but the current situation is that we do not have concrete data.</i> • <i>Because it is necessary to make judgments based on objective data when deciding on measures</i> • <i>Current CO2 emissions calculations are not credible</i>
Cooperation with other municipalities for exchanging knowledge and best practices, and for joint subsidy applications	E2.3 / E3.3	• Sharing knowledge and best practices from other cities, including through participation in inter-municipal networks, is beneficial • Cooperating with neighboring municipalities is crucial to qualify for national subsidies like "Leading Low-carbon Regions"	• <i>Because we believe that by efficiently collecting examples from other cities, etc., it will be possible to formulate effective measures</i> • <i>[I]t is also important to gather information and know-how via inter-municipal networks; this can readily provide the building blocks for designing the policies that municipalities should pursue.</i> • <i>Because that is, in fact, the case with applications for "Decarbonization Leading Areas."</i>
Shared vision and consensus throughout the entire administration are essential and can be fostered through enhanced organizational strategies	E3.1 / E3.2 (E1.1; E2.1; B3.2; B4.5)	• Greater climate awareness and shared understanding among all staff lead to a stronger sense of ownership over climate policy across the entire local administration. This potentially contributes to: (1) having a broader impact of measures (2) having more coordinated actions that are less siloed and more likely to succeed in implementation (3) maintaining a shared understanding across the entire local administration despite staff rotations between departments (4) municipal government setting an example for local residents	• <i>[B]y having employees outside the environmental department take an interest in climate change, each section will be able to expand initiatives and measures ... in line with the actual situation and new free ideas when designing projects.</i> • <i>Due to personnel changes, no specific staff member will continue to perform the same work in the same department ... since horizontal connections between other departments are also necessary, we believe that it is important for many staff to have knowledge and interest ... to make continuous efforts.</i> • <i>If each staff member can see climate change as their own phenomenon, they can incorporate climate change measures into their work. [E]ven in projects that are not directly related to climate change (disaster drills, etc.), it will be possible to raise awareness ... among citizens and others...</i> • <i>It is important for each and every city employee to have an awareness of participation in zero-carbon initiatives, to reflect them in each policy, and for their actions to serve as role models for local residents...</i>

	• Potential ways to enhance understanding across the entire administration and promote inter-departmental cooperation include: (1) having a coordinating body that manages and encourages climate action within each department (2) having motivated and capable staff in the climate policy coordinating department who can engage other actors (3) having climate liaison staff in each department responsible for promoting climate action (4) having cross-sectional working groups	• <i>If there is a section within a municipality that organizes each department, it is easy to move in a unified direction.</i> • <i>We plan to promote understanding through the holding of working groups, which are cross-sectional organizations.</i> • <i>[It] is important to secure human resources who will serve as liaisons with each department and who will be responsible for supervising within each department.</i>
Cross-departmental cooperation is essential for implementing measures in an integrated way and for pooling sectors' authorities and capacities ET-11	E3.2 (E1.1; E1.4) • Since climate action must be taken by the whole agency, horizontal collaboration across departments is essential for coordination and broad implementation of measures. • Climate action should not be limited to the environment department alone. A responsible division cannot act without cooperation from other departments and sectors, even though climate action is often not their top priority due to urgent responsibilities in their own fields of jurisdiction. • Cross-departmental collaboration helps implement measures smoothly and combines authority and expertise. For example, operating infrastructure or retrofitting public facilities to low-carbon standards requires mandates and knowledge from different departments (e.g., construction, energy, city planning, finance, etc.)	• <i>Since decarbonization measures must be advanced comprehensively across multiple fields, initiatives will not progress—and the response will become unbalanced—unless there is a cross-sectoral cooperation framework within the organization.</i> • <i>There is a limit to what the environmental department alone can do. (... , in order to convert public facilities into ZEB, it is essential that the person in charge of design and construction ...has knowledge and actively engages...). We believe that it is necessary for each department to consider the environment in its own work.</i> • <i>It is difficult for the section in charge alone to implement energy-saving measures and renewable energy in public facilities ... it is necessary to implement projects in cooperation with each section ... to coordinate measures with each section's plan ... collaboration is important.</i> • <i>In order to promote zero carbon ... it is necessary to work in an integrated manner across departments ... to apply for government subsidy projects, consensus must be formed within the agency ... it is essential to build a cooperative system throughout the agency.</i>
Cooperation with neighboring municipalities is vital for joining efforts towards wider-area action ET-12	E3.3 (E1.5; E2.1; E2.3) Cooperating with other municipalities, especially neighboring ones, helps to: (1) enable broader-area action; (2) combine efforts for more efficient measures; (3) facilitate joint subsidy applications and subsequent project implementation.	• <i>Rather than taking action only in small local areas, more efficient countermeasures can be achieved by working across the entire surrounding region. [Furthermore] sharing information will raise the overall standard of policy.</i> • <i>Zero carbon and climate change countermeasures are not carried out by a single municipality, but should be developed as a wide-area administration.</i> • <i>Because it is exactly the content of the “Decarbonization Leading Areas” [subsidy] application.</i>

ET-13	Strong alignment along the vertical axis between national, regional, and local levels of government—especially with more proactive coordination efforts by the upper echelons—contributes to effective and holistic action	E3.4 (E1.3; E3.1; E3.2; E3.3; E3.5; E4.2)	• A shared vision and cooperation among all levels of government (local, regional, and national) are essential for progress • Particularly proactive effort and leadership from prefectural and national levels are needed to support municipalities in working together towards coordinated (i.e., whole-of-government) local action	• <i>[M]utual cooperation between the national government, prefectures, and municipalities is important.</i> • <i>[G]lobal warming is not an issue for a single municipality alone.</i> • <i>[T]here is no denying the difference in temperature between the prefecture and other municipalities in the prefecture. [T]he prefectural government [should] actively implement measures ... and spread them throughout the prefecture.</i> • <i>We understand the arrangement whereby the national government presents a framework and municipalities are given discretion. However, under the banner of “tailoring to local conditions,” that discretion is excessive, [and there is] weak legal enforceability. Thus, we struggle to explain the necessity of decarbonization measures both inside and outside the city [government], and we need top-down support and cooperation from higher levels...</i>
ET-14	Engaging stakeholders facilitates better consensus-building	E3.5 (E4.4)	• Building consensus with stakeholders is a complex process, often because of differing opinions, but it is crucial for effective decision-making • Wider consensus should be strengthened through opportunities for dialogue, opinion exchange, and awareness-raising • It improves the spread of initiatives among more actor groups	• <i>Proactive policy formulation with local stakeholders will enable the region to work together as one, but on the other hand, ... difficult to raise the motivation of stakeholders and to achieve consensus due to various opinions.</i> • <i>The cooperation of ward residents and business establishments is essential, but there is a shortage of places to build consensus.</i> • <i>[W]e will foster momentum for measures against global warming in the city by creating a place for dialogue with various stakeholders, including the young generation who will lead the next generation, and by creating a mechanism for building and sharing a decarbonized lifestyle image...</i>
ET-15	Engaging the private sector is crucial to increase private actors' involvement and active participation in implementation, whether working together with local government or through independent action	E3.5 (BE1.2; M1.2)	• Municipal governments should lead but cannot act alone; they require active stakeholder involvement. Engaging stakeholders is crucial for: (1) implementing measures that are locally appropriate (2) achieving broader impact (3) improving the feasibility of implementing measures (4) increasing effectiveness • Engaging the private sector in climate action is essential, including: (1) through public-private partnerships (2) by encouraging private sector stakeholders to adopt their own voluntary measures and initiatives • Engaging industrial sector actors is especially important as they often represent a large share of the city's GHG emissions	• <i>Since this is not a project that can be promoted simply by the government waving a flag, I believe that it is important to make efforts that involve stakeholders outside the administration.</i> • <i>In order to implement climate change measures suitable for the region, we believe that coordination, cooperation ... with regional stakeholders are necessary.</i> • <i>Because climate policy involves deploying measures across a wide range of areas, the cooperation of citizens and businesses is necessary; therefore, we consider it extremely important.</i> • <i>To implement policies with high feasibility and effectiveness, the cooperation of local stakeholders is necessary.</i> • <i>This is because ... public-private partnerships are indispensable for decarbonization.</i> • <i>In aiming for a decarbonized society, it is necessary for all actors to independently and actively promote initiatives on their own...</i> • <i>Due to the city's unique circumstances—specifically, that 80% of its sectoral emissions come from the industrial sector.</i> • <i>If we can work together with stakeholders facing regional issues, we can make faster decisions, implement them, and achieve more accurate results.</i>

		• Engaging large business players is vital since they have the capacity and scale to lead regional decarbonization (however, they are often absent in rural towns) • Working with local stakeholders facing regional issues can make climate action more synergistic with addressing local problems and help accelerate decision-making and implementation. As a result, collaboration creates positive cycles for the local economy, such as fostering revitalization	• <i>[A]pproximately 35% of CO₂ emissions within the city ... from the industrial and about 20% from the commercial sectors. With the cooperation of local businesses and financial institutions, it will be necessary to create decarbonization-related businesses that drive both decarbonization and a virtuous cycle in the regional economy.</i>
ET-16	Climate champions, both public and private, are essential for raising awareness and motivating action among local stakeholders E4.1 (E3.5; E4.3; E4.4)	• Municipal leaders' enthusiasm promotes awareness among local stakeholders, thereby increasing stakeholder support and involvement • Not only political leaders, but also private sector leaders are important	• <i>[I]deally, we should advance dissemination/outreach measures under the mayor's leadership—including raising public awareness.</i> • <i>[C]larifying the direction of the city by the leaders will enable the cooperation of citizens and stakeholders.</i> • <i>Implementing climate change measures requires strong leadership, including from the private sector.</i>
ET-17	The role of local government leaders in fostering internal consensus and decision-making for climate action is crucial E4.1 (M1.2; E1.1; E3.2)	• Because local government leaders hold the final responsibility for municipal budget drafting and resource allocation, their support enables both decision-making and implementation of climate measures. • Local government leaders play a vital role in building internal consensus by leveraging their significant decision-making power and top-down authority to: (1) implement decisive decisions, and (2) reduce barriers for cross-departmental coordination and agreement. • While steady leadership by working-level divisions is essential, it should be backed by top-down political leadership from the mayor or chief executive	• <i>Because the final decisions on allocating resources—such as funding and personnel—largely rest with the mayor.</i> • <i>Because the chief's top-down approach lowers the hurdle to coordination with other departments.</i> • <i>If there is a leader who promotes zero carbon, it is easier to make policy decisions ... having or not having a chief who understands the perspective of regional revitalization combined with decarbonization will be significant.</i> • <i>I feel that achieving zero carbon requires both: (1) a steady accumulation of results at the working-level, and (2) sweeping, top-down measures.</i> • <i>Because the views of political leaders and the ways they promote Zero Carbon City initiatives—including planning and fiscal approaches—are highly influential.</i>
ET-18	Local government leaders play a crucial role in envisioning the future, setting direction, elevating priorities, and ensuring accountability. E4.1 (E1.6; E4.3)	• Municipal leaders set priorities • Having municipal leaders who can convincingly present a vision of the municipality's future, including net-zero goals, is important. • To realize such a future vision, leaders need to: (1) understand and promote climate action synergies with local issues; (2) have a convincing data basis for its achievability; (3) set and uphold responsibility for its achievement;	• <i>Unless [municipal] leaders demonstrate leadership and raise policy priorities, progress will not be made. It is necessary for citizens to understand this.</i> • <i>The policies we should pursue are determined by our future vision. Therefore, the presence of a leader who can articulate the desired (ideal) vision of a future decarbonized society carries significant weight.</i> • <i>The mayor is taking the lead in publicly announcing climate measures and is seeking to link them to regional revitalization.</i> • <i>It is important because when the mayor—the head of the administration—sets a clear direction, such as declaring net-zero CO₂ emissions, it makes it possible to drive policies forward. When indicating such a</i>

		(4) take initiative ahead of national or prefectural governments	<i>direction, it is necessary to lay out a certain level of supporting rationale (evidence that it is achievable).</i> • <i>If there are indicators in place—that show the degree of achievement of the mayor's campaign pledges—then climate measures are likely to be proactively advanced.</i>
ET-19	Envisioning and steering roles of upper-level government: establishing a long-term vision and strong direction, thereby motivating stakeholders (both state and non-state) to participate in climate action	E4.2 (E3.5; E4.4) • National/regional long-term vision provides impetus, lends a driving force, sets guidelines, and helps overcome short-termism • An established future direction strongly promoted by the higher-level government increases awareness among municipalities and enhances communication with citizens • The country's leadership and vision motivate local governments, offering a supportive foundation for their policies	• <i>Achieving carbon neutrality requires strong impetus and cannot be achieved without national political leadership based on a long-term vision.</i> • <i>I believe that the national government taking the lead, establishing guidelines, and clearly indicating the direction will lead to proactive efforts by local governments.</i> • <i>This is because the national government can clearly state its vision to make it easier for local governments to formulate policies related to climate measures.</i> • <i>It is also important to be prompted—and supported—by initiatives at the national level.</i>
ET-20	Strong technical/instrumental role of upper-level government: establishing a comprehensive high-level support system that facilitates effective local climate action	E4.2 (E1.2; E1.3; E1.5; E1.8 E2.1) • A strong high-level support system established by the upper-level government: (1) provides supportive legal and regulatory frameworks and specific practices to move local action beyond mere planning toward implementation; (2) leverages jurisdiction over broad policy sectors (e.g., energy, industry, transport) to ensure alignment and authority fit; (3) mobilizes scale and capacity—through fund allocation and technology development—that municipalities cannot secure on their own.	• <i>Under the current legal and regulatory framework, at the stages of identifying emissions and formulating plans, it feels as though the choice of concrete measures is left entirely to each municipality. If specific measures were set out in law, municipalities would find it easier to act.</i> • <i>GHG reductions are largely influenced by national energy policies, and measures are needed at the national level, especially in the industrial and transportation sectors.</i> • <i>We believe that funds and technology are indispensable for energy measures, and that they should be developed efficiently and effectively under the leadership of the national and prefectural governments.</i>
ET-21	Fostering a local community political environment and will for climate action—through education and the cultivation of the city's environmental history	E4.3 (M4.1; E4.4) • Efforts to educate and raise awareness among residents are crucial for promoting climate action on the local level, building community support from the ground up, and encouraging increased independent action • Recognizing the history of efforts provides a foundation for higher goals	• <i>[I]t is necessary to link the effort with areas such as education, make it a consistent, municipality-wide initiative, and foster momentum for citizens to consider environmental issues at the level of public awareness.</i> • <i>It is important that we have a history of citizens, businesses, organizations, and the city working together to advance measures against global warming, and—with a proper recognition of that history—we must continue to build on it toward higher targets.</i>
ET-22	Promoting an elevated and continuous (i.e., long-term) status of climate action on the local policy agenda through synergies and local leadership	E4.3 (E1.6; E4.1) • Long-term continuity of policies is important for stable progress towards set targets • Synergies with other regional issues and goals help establish and elevate climate action's priority on the local agenda • Presence of leaders who work on continuous environmental agendas	• <i>If we can approach projects with a long-term perspective, we can set firm targets and advance them steadily without being swayed by short-term circumstances.</i> • <i>[I]t is important that the measures are consistent with local goals and plans (synergistic effects).</i> • <i>We need leaders who work on policies that are continuous.</i>

Heightened community awareness—including resident sentiment, ownership, and pride for the city’s initiatives—contributes to stronger bottom-up support for net zero	E4.4 (M4.1; E4.3; E4.1)	• Fostering positive citizen sentiment toward climate action, cultivating ownership of policies and initiatives, and building pride in past achievements or forward-looking commitments all contribute to strong bottom-up support. • Responding to citizens’ views and concerns—both positive and negative—enhances the legitimacy of climate action and fosters better understanding among residents. • A high level of citizen awareness and interest influences whether investments are allocated to implementation projects.	• <i>It is important to carry out policies that citizens can be proud of.</i> • <i>Since our city has received multiple inquiries from citizens who have opinions and ideas about climate change, we need to proceed while taking such views into account.</i> • <i>Due to the unchecked proliferation of mega-solar developments ... and how they are reported in the news, public attention toward introducing RE has grown increasingly negative. Therefore, we need to shift local residents’ attitudes in a positive direction... and accelerate efforts through public–private collaboration.</i> • <i>If residents are not interested, [climate action] will not be put forward as a policy or manifesto, and investors ... will not gather.</i>
Fostering independent voluntary action by local stakeholders is essential for effective municipal climate action and progress toward net-zero	E4.4 (E1.2; E3.5)	• Stakeholder involvement in policy implementation and independent, voluntary action by local actors are crucial (thereby necessitating local government’s awareness-raising efforts) • Fostering bottom-up independent action by residents and businesses is essential because: (1) they contribute significantly to GHG emissions; (2) local governments have limited capacity and resources; (3) large-scale impact and broad coverage depend on citizen and business participation; (4) ultimately, citizen ownership of the city’s future • Facilitating broader climate action depends on collaboration between local governments and the private sector, including through public–private partnerships • Activities conducted by proactive civil society organizations are essential at the ground level	• <i>It is important that awareness permeates not only leaders but also residents.</i> • <i>It is desirable that initiatives be advanced on a voluntary, self-motivated basis. To that end, we believe awareness-raising is necessary.</i> • <i>Rather than tackling the issue through strong top-down leadership, it is important that everyone regards climate problems as their own concern.</i> • <i>Because per-capita CO₂ emissions in the household sector are higher than the national average, and the share of automobiles among transport modes is also high, the cooperation of each and every citizen is indispensable for achieving reductions.</i> • <i>It is the townspeople who will create the future of the town.</i> • <i>[W]e need to ... accelerate efforts through public–private collaboration.</i> • <i>At the ground level, the activities of civic groups are extremely important...</i> • <i>[I]f we can secure even one strong driver—such as ... robust backing from civic groups—we believe the effort will move forward.</i>

Notes: ¹ *Major items* refer to the questionnaire choices respondents identified as the “single most important” in each category, which provided the context for their open-ended explanations. These items are part of the analytical framework developed from the literature (see Chapter 2, Tables 2.1-2.3). *Related items* are those explicitly or implicitly mentioned in responses and showing correlations above $r > 0.3$ (see Chapter 4 for correlation analysis results). Codes “M,” “B,” and “E” denote Motivations, Barriers, and Enablers respectively (“BE” indicates both Barriers and Enablers). Source: Created by author.

The tables make two primary contributions. First, they provide a comprehensive overview of the core rationales (MBEs) expressed by municipal officials, enabling readers to grasp at a glance both the breadth of themes and the qualitative depth that supports them. Second, by incorporating related factors, they draw attention to potential interconnections across motivations, barriers, and enablers. Both themes and their potential connections are analytically valuable, as they suggest avenues for deeper investigation through case studies, comparative analyses, or hypothesis testing. Taken together, the results not only document the themes that emerged from the qualitative data but also establish a rich foundation for hypothesis generation and theory-building in the study of local climate governance.

Since the tables present the themes in a condensed and compact form, the following Discussion provides a fuller narrative account. Here, the themes are explored in greater depth, with attention to their meanings, the rationales they reveal, and the ways they help explain the survey rankings. The discussion also illustrates the broader interplay of motivations, barriers, and enablers in local climate governance. At this stage, however, the analysis remains primarily descriptive: relationships between factors and themes are noted only tentatively, in order to preserve original detail, context, and transparency. The task of deeper synthesis—such as abstraction into higher-order meta-themes—is left for subsequent analysis (see Chapter 7).

5.4 Discussion

The thematic analysis yielded 66 themes (26 motivation, 16 barrier and 24 enabler themes), which, supported by respondents' own words as documented in the Results tables, illuminate why municipalities aspire to climate action, the obstacles that hinder them, and the factors they see as potential facilitators of net zero. Read alongside the quantitative survey results reported in Chapter 4, these insights add essential depth to the rankings and reveal the crucial “why” behind municipal choices. The themes function as compact, meaning-rich lenses into municipal reasoning: each can be considered in its own right, while together they form interlocking pieces of a larger puzzle that offers a holistic view of motivations, barriers, and enablers in local climate action. What follows is a narrative overview of these themes, signposted with references to the Results (tables 5.3–5.5), allowing readers to trace the discussion back to the empirical material.

5.4.1 Dominance of Economic Motivations among the Top Ranks Explained

5.4.1.1 Financial Merits as Motivations (M1.1): Why Economic Incentives Remain Central to Municipal Climate Action (MT-1–MT-4)

One major reason why financial benefits ranked so highly as a motivation is their perceived role in convincing and incentivizing stakeholders to participate in climate initiatives. Officials emphasized that without demonstrating clear economic advantages, it is difficult to build both

consensus around the necessity of action and the broader buy-in needed for joint initiatives, rather than leaving climate action solely to local governments (or even to a single responsible department) acting alone (*MT-1*).

A second rationale stems from the fiscal stress experienced by many municipalities, which makes the presence of financial co-benefits a precondition for policy adoption (*MT-2*). Within this context, respondents framed climate action motivation using a constraint-driven angle: because of budgetary pressures, municipalities cannot realistically pursue measures without adequate financial returns. This nuance significantly enriches the quantitative findings. What could otherwise be interpreted as a straightforwardly high proportion of municipalities motivated by potential financial gains is more complex: many respondents were not saying that financial merits had already been identified, but rather that *there must be such merits*, otherwise action is simply not viable. In other words, for many, financial merits are not so much an attractive “pull factor” but rather a non-negotiable condition of the viability of climate policies. In this way, climate action is perceived as a menu of possible measures, but only those with credible financial returns are perceived as plausible and feasible. Other non-economic co-benefits—such as livability or branding—were acknowledged by these municipalities as important motivations but seen as too weak on their own to justify action.

Relatedly, some municipalities frame their rationale simply as “economy above all” (*MT-3*). This frame, although seemingly self-explanatory (some respondents provide little elaboration), can also include insightful case-specific reasoning. For example, one rural municipality noted that, being largely covered with forest, it was “already in a net-zero state.” Their decision to join the Zero-Carbon City movement was therefore not primarily environmentally driven, but rather motivated by the potential economic benefits of cooperation with other municipalities, such as through joint projects or carbon offsetting schemes that could bring investments to forested rural areas.

Alongside these constraint-driven logics, a smaller number of respondents articulated a more opportunity-driven rationale (*MT-4*). Here, climate action was framed as a proactive investment in fiscal sustainability: timely upgrades of infrastructure, such as retrofitting buildings to Zero-Emission Building (ZEB) standards or replacing outdated equipment with energy-efficient alternatives, were seen as a way to reduce long-term costs and avoid the financial burden of maintaining aging and inefficient assets.

In sum, municipalities that prioritize financial merits approach the issue from several interrelated angles: Consensus-building: financial merits are necessary to convince stakeholders and secure broad cooperation (*MT-1*); Constraint-driven: under fiscal stress, only measures with financial returns are viable (*MT-2*); Opportunity-driven: timely upgrades and efficiency improvements can reduce future costs (*MT-4*); Driven by other considerations, such as: seeing financial

potential in cooperation on climate action with peers, or simply prioritizing the “economy above all” logic (MT-3).

5.4.1.2 Revitalization as Motivation (M1.2): Climate Action as a Strategy to Counter Regional Decline and Mobilize Local Strengths (MT-5–MT-8)

For many municipalities, climate action was described as an opportunity to pursue local revitalization. Respondents often framed their engagement with climate policy not only as a way to reduce emissions, but as a strategy to counter local decline (MT-5). Climate initiatives were seen as providing municipalities with a concrete reason to act, and at the same time a chance to address the most pressing concerns in their communities.

This perspective reflects the broader situation in which municipalities in Japan find themselves: prolonged economic downturn, fiscal stress, demographic aging, and youth out-migration reinforce one another in a vicious cycle that is difficult to escape. Against this backdrop, climate action appeared attractive precisely because it could be linked to solutions for these structural problems.

In particular, officials stressed that climate action provides a reason to mobilize around local strengths and utilize local resource endowments (MT-7). For example, leveraging renewable energy potential (favorable solar insulation for solar PV, wind conditions for windmills, water streams for small hydro, etc.), rich forest resources (for sustainable forest management, biomass energy, or for carbon sink and carbon offsets), or other area-specific assets. In this way, municipalities can “kill two birds with one stone”: contribute to national and global carbon neutrality while at the same time revitalizing their local economies.

Crucially, framing climate policy as part of a revitalization agenda is also regarded as an effective consensus-building approach. Because revitalization resonates with widely shared concerns, policies presented in this way are seen as easier to advance across departments and to gain the support of businesses and citizens alike (MT-6).

In this framing, climate action is not seen as competing with economic activity but as a way to align decarbonization with socio-economic renewal. In some responses, this interpretation extended to the idea of a “green recovery” from the COVID-19 pandemic and diversifying local economies (MT-8), further underlining how municipalities expected climate action to contribute simultaneously to environmental and economic goals.

5.4.1.3 Improving Local Energy Conditions as Motivations (M1.3): Local Energy Production–Consumption, Autonomy, and Cooperation as Drivers of Net-Zero (MT-9–MT-12)

The prominence of this “local energy” motivation can be explained partly by its conceptual overlaps with other rationales, especially financial benefits (M1.1) and revitalization (M1.2). For instance, financial gains from climate action are often expressed through energy savings. Yet, the

most prominent way municipalities frame this motive is in terms of “local production, local consumption” of energy (in Japanese: *chisan-chishō denryoku*) (MT-9).

This refers to a scheme where municipalities strive to produce energy locally by utilizing their resource endowments and renewable energy potential, and to do so in a way that contributes directly to the local economy. For example, such projects can generate employment through construction work (e.g., installation of renewable energy facilities), local manufacturing (e.g., producing certain components such as concrete foundations), as well as maintenance, management, and retail — all relying on the local workforce and resources to the extent possible. In this way, both expenses and revenues circulate locally, creating net-positive gains that gradually strengthen municipal budgets and can be reinvested in further development. This dynamic is seen as a promising way to escape the vicious cycle of the regional decline, instead transforming it into a virtuous cycle and contributing to local revitalization. In this sense, climate action is viewed as organically aligned with broader efforts to revitalize local communities, which explains a strong linkage between energy and revitalization motives.

In addition, climate action through energy initiatives is also closely associated with enhanced local autonomy and resilience. By increasing energy self-sufficiency, lowering costs, and improving security of supply, municipalities see these initiatives as a way to reduce dependence on external providers and strengthen disaster preparedness through decentralized and autonomous energy systems (MT-10). Furthermore, since energy expenditures constitute a significant burden on local budgets, reducing them through local renewable generation is regarded as a means of easing the fiscal stress that constrains many municipalities (MT-11).

A further dimension of this motivation concerns stakeholder cooperation. Because energy is a tangible and shared concern, initiatives that draw on local renewable resources were regarded as a compelling basis for uniting municipalities, businesses, and residents around a common, locally grounded enterprise (MT-12). This cooperative potential reinforces the broader perception of climate action as an integrative strategy—one that not only reduces emissions but also strengthens economic resilience, builds social consensus, and revitalizes communities.

5.4.1.4 Summary of Financial, Revitalization, and Energy Motivation Themes

Viewed together, the explanations behind financial merits (M1.1), revitalization (M1.2), and improving local energy conditions (M1.3) clarify why these factors dominate municipalities’ rankings, adding depth to the survey findings on the most salient motivations. The qualitative themes show that municipalities do not simply view the Zero-Carbon City agenda in climate mitigation terms, but perceive it as directly connected to the fiscal, demographic, and developmental pressures that shape local governance. These logics are closely interconnected: financial co-

benefits are important to make climate measures viable, revitalization frames them as a pathway out of decline, and local energy initiatives provide a tangible vehicle to pursue both.

At the same time, this economic framing does not stand alone. Other motivations—such as safety, resilience, and quality of life—can expand, complement, and reinforce economic rationales, making them more compelling to a wider set of stakeholders and supporting stronger, more sustained implementation of climate policies. The following sections turn to these non-economic motivations, showing that while they do not occupy the very top ranks, they offer equally important insights into municipal reasoning and highlight how broader societal values can strengthen and broaden the economic frames.

5.4.2 Insights into Non-Economic Climate Action Motivation

5.4.2.1 Safety and Disaster Preparedness as Motivations (M5): Keeping Communities Safe as a Rationale for Net-Zero (MT22-MT24)

In many open-ended responses from officials who selected safety as the municipality's primary motivation for pursuing net zero, a clear theme emerged: resident safety is a non-negotiable priority and a fundamental responsibility of local government (MT-22). In this view, safety is not just one of many possible co-benefits of zero-carbon, but a factor that municipalities cannot overlook. For several respondents, the essence of net-zero was expressed in this straightforward line of reasoning: climate action is needed because protecting citizens from harm is the municipality's foremost duty. Safety was also described as a locally grounded priority, more immediate and tangible than abstract notions of global contribution or trend-following. From this perspective, the meaning of the Zero-Carbon City is closely linked to adaptation: although formally a mitigation agenda, many municipalities interpret it as a necessary step to shield communities from the negative impacts of climate change.

Next theme that emerged complements the previous framing of safety as a core municipal duty by illustrating how officials see climate action as a concrete means of safeguarding communities from hazards and disasters (MT-23). In this line of reasoning, net zero was described not only in relation to climate-induced risks but also in connection with other natural disasters such as earthquakes. The logic rested on four strands: memories of past disasters, expectations of future risks, awareness of climate impacts already affecting livelihoods, and a perceived connection between mitigation and adaptation. Some municipalities recounted the traumatic experience of devastating floods, mega-typhoons, or earthquakes that caused enormous damage and left lasting scars on their communities. Others pointed to anticipated or ongoing effects, such as declining fish catches linked to warming oceans or falling crop yields due to extreme heat. For these municipalities, the Zero-Carbon City agenda is highly relevant, as it connects directly to risks that residents recognize and fear. The mitigation–adaptation connection was also seen as central to this framing.

Officials referred, for instance, to the potential of decentralized renewable energy systems with storage to provide a reliable backup supply during disaster-related blackouts. Although not directly mentioned in the responses, one can reasonably interpret nature-based approaches—such as green infrastructure for flood control or urban greening to reduce heat stress—as part of this same logic. Taken together, these narratives show how municipalities interpret climate action under the Zero-Carbon City as serving a dual role: not only as a means of reducing emissions, but also as a strategy to confront escalating risks and to integrate adaptation into their broader climate response.

Finally, a further theme highlighted the connection between disaster experience, safety concerns, and stakeholder awareness (MT-24). Municipalities that had suffered from intensifying disasters explained that residents’ awareness of risks was already very high, something also reflected in local citizen surveys. In such contexts, the Zero-Carbon City agenda was seen as a natural extension of these concerns. At the same time, officials stressed that this awareness could serve as a foundation for broader consensus: by framing net-zero in terms of protecting communities from disasters, municipalities could encourage residents and businesses to view climate risks as “their own issue” and to engage more actively in cooperative action.

In sum, the safety/vulnerability-related themes reflect municipalities’ concern with protecting residents, their recognition of linkages between mitigation and adaptation, and their awareness of the safety frame’s potential to build consensus around climate action. The findings from the quantitative analysis of the survey data reinforce this picture: safety was selected as the single most important motivation by around 16% of municipalities and received high importance ratings overall, ranking alongside economic motivations at the top of the list. This combination of strong salience evaluation of the issue in the survey and clearly articulated qualitative rationales underscores the potential of the safety frame to mobilize local actors and strengthen commitment to the net-zero agenda—extending beyond economic considerations and adding an additional layer of motivation for municipalities to pursue climate action. While safety frames emphasize the protection of communities from risks, the following subsection turns to livability and health, where municipalities interpret net zero as a pathway to improve everyday well-being and quality of life.

5.4.2.2 Livability and Quality of Life as Motivations (M2): Enhancing Residents’ Welfare, Health, and Intergenerational Well-Being (MT-13–MT-17)

Beyond the dominant economic frames, another important set of motivations relates to how municipalities connect climate action with livability and the well-being of their residents. Although “improving livability” (M2) ranked below the economy (M1.1–M1.3) and safety-related (M5) motivations (see Figure 4.1), the qualitative responses reveal a wide range of insightful rationales that highlight its importance.

A number of municipalities stated bluntly that citizen welfare is the most fundamental principle of local government operations—its *raison d'être*. In this view, efforts toward net zero are inseparable from the municipality's core mission of improving city services, livability, and overall quality of life (MT-13). Some officials linked this reasoning to the municipality's basic principles enshrined in central decrees and ordinances (e.g., Basic Environmental Ordinances), while also pointing to the self-evident fact that local administrations are the government level closest to residents.

Another line of reasoning emphasized the potential of climate action to enhance well-being and health in multiple ways (MT-14). Officials noted that climate initiatives can help reduce the negative externalities of urban development (e.g., traffic congestion, air pollution). Some also explicitly referred to the necessity of mitigating climate-induced hazards such as the urban heat island effect (which can be addressed in synergy with mitigation measures, such as, for example, the provision of green spaces). Climate action was further associated with promoting healthier lifestyles (e.g., shifting towards physically active modes of transport, or dietary changes). Beyond physical health, some officials also highlighted the psychological dimension of livability, suggesting that climate measures can make everyday urban life easier for residents and, in doing so, create greater mental space and comfort.

The potential of climate action to enhance the city's attractiveness through livability benefits is also acknowledged (MT-15), highlighting another synergy with revitalization objectives. Improved attractiveness is expected to support demographic stability by helping to retain current residents and by drawing in new ones, thereby countering the prevailing trend of out-migration that characterizes many non-central municipalities.

A further theme stressed the role of livability in consensus-building (MT-16). Linking quality of life and health to climate action was described as a powerful strategy to broaden the support base for climate policy beyond narrow economic rationales. From the author's perspective, this deserves greater emphasis in both academic research and policy craft, since it can serve as an effective tool for climate communication. Framing climate action in terms of health and welfare has the potential to foster stronger civic participation and encourage greater uptake of voluntary action and behavioral change.

Indeed, research on climate communication and psychology reinforces this observation. Studies consistently show that health- and livability-oriented climate messages are especially effective in mobilizing public support. For example, Maibach et al. (2010) found that information about the health benefits of mitigation measures was perceived as clearer and more useful than information focusing solely on negative impacts (Maibach et al., 2010), while Kotcher et al. (2021) demonstrated that advocacy messages are most persuasive when they combine solution-oriented content with normative appeals to shared values such as welfare or responsibility for future

generations (Kotcher et al., 2021). Similarly, Hart and Feldman (2021) show that framing climate mitigation measures (specifically, limiting emissions from power plants) in terms of local air-pollution impacts—rather than abstract climate change—enhances the perceived benefits of mitigation policies, which in turn are positively associated with individuals’ intentions to engage in political action (Hart & Feldman, 2021). In urban contexts, these perceived benefits correspond closely to everyday quality-of-life and livability concerns, such as cleaner air and healthier living environments. Although much of this research has examined climate communication at the individual level, the same logic can be extended to collective decision-making in municipalities. Since local governments are made up of individuals—residents, officials, and politicians—frames emphasizing health, welfare, and livability can help build the critical mass of support needed to overcome low awareness, broaden consensus, and strengthen the implementation of net-zero initiatives.

Finally, an intergenerational dimension also emerged, with some municipalities recognizing that while achieving net zero is an important policy target, its deeper purpose lies in passing on “a green, nature-rich, and environmentally friendly city to the next generation” (MT-17). This perspective links naturally with the consensus-building potential of livability and health frames discussed above, since appeals to future generations and residents’ welfare resonate strongly as normative values in climate communication.

Taken together, the qualitative themes in this section highlight that although livability/quality-of-life motivations ranked below economic concerns in the quantitative part of the survey, they provide powerful rationales that can broaden consensus, mobilize civic support, and reinforce the economic logics of climate action. By embedding climate initiatives into narratives of health, welfare, and intergenerational responsibility, municipalities can increase the city’s overall motivation toward net zero, bolstered by wider citizen support and greater perceived legitimacy of action.

5.4.2.3 Responsibility, Identity, Branding, and Global Alignment (M4; M6): Living Up to Responsibilities, Building Civic Pride, and Leading by Example (MT-18–MT-21; MT-25–MT-26)

This cluster of themes reflects how some municipalities frame climate action in relation to their responsibilities and capabilities, their civic identity and pride, their efforts to strengthen attractiveness through environmental branding, and their role in leading by example.

A number of municipalities, particularly those hosting major industries, framed climate action as part of living up to their responsibilities given their high emissions profile and capacities (MT-18). These cities recognized that being home to energy-intensive sectors or large port facilities placed them above national or peer averages in carbon output, creating a strong expectation to act. At the same time, many also emphasized that their industrial base gave them the capacity and opportunity to lead, since cooperation with local industries could generate pioneering

decarbonization projects and new entrepreneurial niches. In practice, such reasoning is often most visible in port cities, where heavy industry and advanced infrastructure are concentrated. While the specific measures differ across contexts, these municipalities commonly look to technological pathways and industrial collaboration—such as hydrogen infrastructure, decarbonizing shipping, or other large-scale innovations—as avenues to turn responsibility into leadership. Their engagement with climate action is therefore framed simultaneously as responsibility and potential: recognizing the need to respond to their emissions context while also leveraging industrial capabilities to pursue innovation and leadership.

Some municipalities linked their climate action to civic pride and environmental identity (MT-19). In these cases, climate initiatives were described as a natural extension of long-standing commitments to environmental stewardship. Cities that had previously engaged in renewable energy earlier than the national average, or those endowed with abundant natural assets and heritage landscapes, often saw net-zero as part of their identity as environmentally conscious communities. In this framing, climate action serves both practical and symbolic purposes: it helps reduce emissions while reinforcing the municipality’s reputation as a place that values nature and sustainability. At the same time, several officials acknowledged tensions between technological mitigation measures and nature conservation. For example, the promotion of large-scale solar facilities was sometimes perceived as conflicting with efforts to preserve traditional landscapes. One municipality put this dilemma starkly:

Our municipality is part of the prefecture-wide effort to register Aso as a World Cultural Heritage Site. Since the maintenance of grasslands and landscape preservation are major prestige, we are not promoting the installation of solar power generation facilities. However, we fully understand the need for renewable energy and are at odds with each other.

This illustrates how municipalities that derive their identity from natural abundance or heritage status often pursue climate engagement in a cautious, nuanced manner – balancing environmental branding with climate measures, given the imperative of protecting landscapes and biodiversity.

Another theme concerned municipalities that strive to increase the attractiveness of their region through environmental action, including climate initiatives (MT-20). This is part of broader efforts to promote revitalization and stabilize demographic trends, with environmental achievements contributing both to the community’s brand and to how residents themselves evaluate their locality. At first sight, this overlaps with the “enhanced livability leading to improved area attractiveness” motive (MT-15), a framing used by municipalities that selected the inward-oriented “residents’ QoL/health” (M2) as their most important motivation. In contrast, the responses linked to M4.1 reflect a more outward-oriented “Green city brand/identity” rationale, where environmental action is framed as directly contributing to the city’s external brand and image. Within this

outward-oriented frame, municipalities either emphasized the Zero-Carbon designation itself as strengthening the city's image, or pointed to pioneering demonstration projects (e.g., deep-sea water pumping, ocean thermal energy conversion) as opportunities to build a distinctive profile. Such initiatives were presented as strategies to generate revitalization effects—retaining residents, attracting newcomers and tourists, and drawing investment—through cultivating a pioneering city image. Similar dynamics were observed in fieldwork¹², for example, in Goto City (an isolated island municipality in Nagasaki Prefecture), where floating offshore wind development was discussed in comparable terms. Notably, while this motivation frame is conceptually associated with high-capacity and ambitious municipalities, in practice, it was often employed by smaller municipalities that saw climate action as an opportunity to improve socio-economic and demographic conditions by becoming known for distinctive environmental initiatives. Indeed, although such projects usually require cooperation with higher-level governments, research institutions, and private partners, they nonetheless depend on municipalities taking the first step, reflecting a proactive stance that combines branding ambitions with local leadership (Myasoedov & Ota, 2021).

Finally, although elaborated only by a few, some municipalities emphasize the role of local government in leading by example (MT-21). The reasoning here is that municipal administrations must demonstrate commitment through their own actions if they expect other actors to follow. In this framing, the municipality's proactive pursuit of climate policy is not only about implementation but also about communication—signaling direction, raising awareness among local stakeholders, and encouraging cooperative action by businesses, residents, and other institutions.

5.4.2.4 Summary of Non-Economic Rationales for Climate Action

The non-economic motivations capture how municipalities that selected these factors as most important explained their reasoning in terms that go beyond financial or developmental logics. For these respondents, climate action was primarily framed as a matter of protecting residents, improving everyday well-being, or fulfilling broader civic and global responsibilities. Safety and disaster preparedness (M5) were repeatedly described as a non-negotiable duty of local government and strongly reinforced by past experiences of disasters, with many officials interpreting net-zero as closely tied to adaptation imperatives. Livability and health (M2) connected climate action with municipalities' basic mission of improving welfare and quality of life, while also offering a powerful communication frame that can strengthen consensus and civic participation, including through intergenerational appeals. Finally, responsibility, identity, and branding frames (M4; M6) highlighted the importance of civic pride, municipal leadership, and alignment with global norms as rationales that help legitimize climate policies and extend their reach.

¹² See next chapter, Section 6.3.1 for fieldwork insights. The case of Goto City is described in publication “Pathway to a Zero Carbon City: Island of Energy, Goto City, Japan” (Myasoedov & Ota, 2021)

Although the quantitative findings of the survey data show non-economic motivations ranking below economic ones, their qualitative elaborations enrich the picture of why municipalities commit to net zero. They emphasize values that are immediately meaningful to residents and stakeholders, broaden the base of support for climate policy, and help anchor mitigation goals in narratives of welfare, safety, and responsibility. Taken together, the non-economic frames complement the economic logics, extending and strengthening the overall motivational drive behind local governments' commitment to net-zero futures.

5.4.3 Themes Explaining Barriers and Enablers of Local Climate Action

5.4.3.1 Municipal Capacity in Terms of Resources and Authority (BE1.1-BE1.8): How Financial and Organizational Constraints Shape the Priority of Climate Action (BT-1–BT-5; ET-1–ET-5)

Under the category of “Municipal Capacity: Resources and Authority,” respondents voiced a range of concerns, particularly around the availability of financial resources, staffing, and the authority to coordinate climate policy. Indeed, these issues stood out in the quantitative analysis results, where they consistently topped the ranks of the most significant barriers and enablers of climate action toward zero-carbon cities. The qualitative responses add depth to these findings by illustrating how officials experience these issues in practice, and by highlighting the kinds of institutional and financial changes they regard as necessary enablers. The following themes unpack how these capacity-related challenges and opportunities are understood at the municipal level.

One of the most frequently emphasized concerns was the insufficient financial capacity of municipalities to pursue climate action effectively. Officials noted that while many measures promise long-term benefits, the high upfront costs make them difficult to pursue in already constrained fiscal environments. Municipal governments must prioritize core services and avoid placing extra burdens on residents or jeopardizing local socio-economic stability, and under such conditions their own efforts alone are seen as insufficient—especially for initiatives that extend beyond municipal facilities. As a result, additional financing is regarded as indispensable. In practice, this usually means turning to subsidy schemes provided by national or prefectural governments to support zero-carbon projects. Yet these schemes were the subject of strong criticism in many responses: they were described as too narrowly scoped and project-based rather than systemic, too complex and time-consuming to apply for, too competitive relative to demand, and ultimately too limited in scale to cover actual costs (*BT-1; BT-2*).

At the same time, municipalities consistently emphasized that private-sector involvement is indispensable. Respondents noted that without stronger incentives, it remains difficult to motivate businesses to take action; however, they also stressed that municipal efforts alone will never be enough. The private sector was regarded as essential not only for unlocking additional budgets and investment, but also for bringing human resources, technological expertise, and wider reach.

In this sense, private participation was framed as a necessary complement to limited local government capacity and as a critical ingredient for expanding the overall vitality and scale of the decarbonization effort.

Indeed, local governments' efforts are widely acknowledged as limited, particularly because of a lack of staff. Low personnel numbers—both in the departments directly responsible for climate action and across the administration more generally—were a recurring theme in the open-ended responses, appearing in relation to many barrier and enabler factors. Climate action is typically assigned to environmental departments, but in smaller municipalities such departments may not even exist as separate entities. Meanwhile, overall staffing levels have not increased, so climate responsibilities are added on top of already heavy workloads. Under these conditions, environmental staff are underfunded, overstretched, and ultimately unable to meet the highly labor- and resource-intensive demands that a net-zero transition entails (*BT-3*).

All these issues—insufficient budgets and staffing, low uptake by the private sector, high costs of measures, and inadequate support schemes—make it increasingly difficult for municipalities to build the consensus needed for climate action. When resources are scarce and administrative capacity is stretched, officials and stakeholders tend to prioritize more immediate and pressing obligations, while climate measures are seen as additional burdens that can be deferred. As a result, climate policy often slips down the list of municipal priorities, leaving it marginalized on the local agenda (*BT-5*).

Emerging qualitative themes among the enablers in this category often overlapped with the barriers, frequently appearing as their mirror images—describing what municipalities would like to have in place, as opposed to the current limitations they face. In relation to staff shortages and the generally marginalized position of climate policy within administrations, respondents emphasized the need for an enhanced organizational structure dedicated to climate action, sufficiently empowered and equipped with adequate staff numbers. Such strengthening was described as imperative for departments to be able to work more effectively across municipal divisions and to draw on human and financial resources from other sectors (*ET-1*).

Perhaps the prerequisite for this to happen, however, are the following enabler themes that emerged. First, some officials stressed the close interdependence between budgets and staffing: without sufficient funds it is difficult to hire or retain personnel, and without staff municipalities lack the capacity to make use of additional resources. This reasoning was often tied to calls for improving subsidy schemes, which—as noted in the barriers—were described as inflexible, overly complex, or insufficient. More flexible and adequate subsidies were seen as essential to unlock additional financing, both for securing municipal climate governance experts and for creating incentives to engage local businesses and residents (*ET-3*). Second, some responses pointed to the private sector as a vital source of resources and dynamism. Officials noted that private actors could

bring not only investment but also human capital and expertise, thereby boosting the vitality of decarbonization efforts across the region. In this view, active business participation would help unlock further budgets, broaden diffusion, and extend the reach of climate initiatives beyond what local governments can achieve on their own (ET-4).

Some responses stressed that even if additional resources were made available, this alone would not be enough to generate sufficient action through voluntary efforts. Officials emphasized the importance of a supportive nationwide legal framework to clarify the responsibilities of different actors, establish a clearer rationale for action, and create the conditions for broader stakeholder involvement. In this view, stronger legal underpinnings were seen as essential to move beyond fragmented voluntary initiatives and to foster more systematic and widespread participation in decarbonization efforts across sectors and regions (ET-2).

At a different angle on the call for legal prerequisites was the emphasis on identifying and leveraging synergies and co-benefits to strengthen the case for climate action. Respondents noted that it is important to identify clear and compelling merits for the local community that extend beyond mitigation alone. When climate measures are framed as contributing simultaneously to other local objectives—such as economic development, public health, or disaster preparedness—they become more persuasive and easier to justify. Such co-benefits were therefore described as a crucial enabling factor for building the consensus required to support effective local action (ET-5).

In sum, municipalities consistently portrayed resource and authority constraints as decisive for shaping their capacity to act. Respondents emphasized insufficient budgets, limited and inflexible subsidies, staff shortages, and difficulties engaging the private sector as key barriers, alongside concerns that climate action often ranks low on the municipal agenda. At the same time, the enablers identified were often the mirror images of these barriers: stronger organizational structures, improved subsidy schemes and budget–staff linkages, more active private-sector engagement, supportive legal frameworks, and the use of co-benefits to tie climate action to broader community goals. Together, the themes indicate that questions of resources and authority are not just background conditions but central determinants of whether municipalities can treat climate action as a sustained priority rather than a marginal concern.

5.4.3.2 Municipal Capacity in Terms of Knowledge and Expertise (BE2.1-BE2.3): From Expertise and Data Shortages to the Enabling Role of Knowledge Systems and Cooperation (BT-6–BT-7; ET-6–ET-9)

Within the category of “Municipal Capacity: Knowledge and Expertise,” respondents emphasized challenges related to the lack of specialized expertise and to difficulties in accessing and managing data. The results of the quantitative analysis on the closed-ended questions described in

Chapter 4 indicate that insufficient in-house expertise and difficulties in handling data within local administrations dominated the rankings in this category. The qualitative responses add depth to these findings by showing how such constraints are experienced in practice and by highlighting the enabling conditions municipalities see as necessary to overcome them.

A first theme concerns the lack of specialized knowledge and expertise among municipal staff (*BT-6*). Respondents explained that climate responsibilities are often assigned to generalist officials who rotate frequently between departments, making it difficult to accumulate specialized knowledge or build continuity in climate governance. In smaller municipalities, where dedicated environmental or climate units may not even exist, these responsibilities are typically absorbed by staff already managing multiple tasks, further diluting expertise. One insightful response also noted that while outsourcing to external consultants can provide technical support, it does little to build in-house knowledge or ensure that plans reflect local contexts. Further, the absence of skilled staff at decision-making levels was highlighted as particularly problematic, since it weakens the ability of municipalities to design credible policies, to integrate climate action into broader development agendas, and to maintain ownership of their strategies.

A second barrier relates to difficulties in acquiring and utilizing reliable data (*BT-7*). Respondents explained that municipal greenhouse gas inventories are often based on proxy estimations that downscale national or prefectural totals. Such figures are aggregated, approximate, and fail to capture the effects of local policies, making it difficult for municipalities to track progress or demonstrate results. Officials also pointed to the complexity of data management: collecting and organizing information across sectors is time-consuming, and access to primary data from utilities or companies is often restricted. These limitations leave municipalities without the solid evidence base needed for policymaking, monitoring, or persuading stakeholders of the effectiveness of local climate initiatives.

On the enabler side, respondents emphasized the importance of adequate staff expertise across both dedicated climate units and other municipal departments (*ET-6*). Skilled officials were described as essential for developing evidence-based policies, for identifying synergies between climate measures and other policy objectives, and for building the kind of consensus needed to sustain climate action. Unlike reliance on external consultants, in-house expertise was seen as allowing municipalities to anchor climate initiatives within their own governance structures, ensuring that measures are not only technically sound but also embedded in the broader priorities of the administration. In this way, sufficient expertise was portrayed as a foundation for turning climate ambitions into coherent and widely supported local strategies.

Another set of enablers focused on improving data systems. Respondents pointed to the need for simplified data collection procedures and easier access to relevant information (*ET-7*), noting that current approaches are overly complicated and place a heavy burden on limited staff

capacity. Streamlined methods and centralized, user-friendly platforms were described as crucial for reducing this workload and enabling municipalities—particularly smaller ones with limited technical resources—to engage in meaningful climate planning. Beyond simplification, respondents also emphasized the value of maintaining an accurate and continuous grasp of local conditions through actual, time-series data (*ET-8*). Such data was seen as indispensable for setting realistic policy roadmaps, for monitoring and evaluating progress, and for strengthening buy-in by making climate impacts and mitigation outcomes more visible to residents and businesses.

Finally, some responses emphasize the importance of inter-municipal cooperation for knowledge and expertise (*ET-9*). Cooperation is described as taking several forms: exchanging best practices and technical know-how, learning from pioneering municipalities, and in some cases jointly applying for subsidies or conducting shared projects. Such collaboration is regarded as an effective way to compensate for individual capacity gaps, while also creating opportunities for mutual learning.

In sum, municipalities identified gaps in expertise and data as major obstacles, but also as areas with the greatest potential leverage. Without skilled staff and reliable information, climate strategies risk remaining generic or externally driven¹³; with them, municipalities can design evidence-based policies, link climate action to other local priorities, and build consensus more effectively. Respondents pointed to several pathways forward: strengthening in-house expertise, simplifying and improving data systems, ensuring continuous monitoring, and sharing knowledge through inter-municipal cooperation. Taken together, these insights suggest that developing the intellectual and informational foundations of climate governance is as crucial as providing financial resources, and that investment in knowledge capacity may deliver disproportionate returns by empowering municipalities to act more strategically and collaboratively.

5.4.3.3 Institutional Coherence; Coordination and Cooperation among Actors (BE3.1–BE3.5): Why Fragmented Systems, Weak Coordination, and Limited Cooperation Hinder Climate Action, and How Integration and Collaboration Can Enable It (BT-8–BT-11; ET-10–ET-15)

Without an organized and well-coordinated system for promoting climate policy, even considerable capacities will fall short of delivering impactful action. Such a system must bring together the combined efforts of multiple actors—government at all levels, businesses, residents, academia, and others. It begins with fostering a shared concern and common understanding of climate policy within the local administration and establishing a unified whole-of-government approach. This involves both vertical coordination across national, regional, and local levels, and horizontal coordination—internally among administrative departments and externally with peer municipalities in the surrounding region. Equally important is active communication and

¹³ For instance, by temporarily hired consultants

collaboration with wider stakeholders, particularly private actors, to build consensus and encourage broad participation in realizing the city's zero-carbon vision.

In the original framework, issues of internal organization and coordination within local government were separated into two factors: B3.1 (rigid administrative work culture, with climate not incorporated into staff routines) and B3.2 (insufficient inter-departmental cooperation on climate policy). However, analysis of the barrier-related open-ended responses shows that these concerns merged in practice into a single integrated theme: “The current organizational system is not conducive to unified administration-wide policy planning” (BT-8). This highlights the close inter-connection between the administrative work ethos and horizontal coordination across departments. Respondents emphasized that current systems for planning, coordination, and execution of climate policy are inadequate and fall short of what is required to achieve municipal net-zero goals. As also reflected in barrier categories I and II, dedicated climate staff are both too few and overstretched, while lacking specialized knowledge and expertise. Meanwhile, staff in other departments—faced with their own responsibilities and capacity constraints—tend to regard climate-related work as outside their remit, an extra burden, and ultimately respond with a “not my job” attitude. This lack of shared understanding and ownership undermines consensus-building and administration-wide cooperation. All these issues are entangled in the phenomenon conventionally known in Japan as *tatewari gyousei* (literally “vertically segmented administration”) – a term that describes the tendency of the Japanese bureaucracy to operate in a siloed fashion. Another dynamic that adds to the difficulty is the tendency to prioritize economic efficiency above all other considerations: given the persistent perception of fiscal strain in municipalities, unless benefits are made clearly visible, other concerns such as environmental objectives are unlikely to gain traction, owing to their low political priority and lack of immediate results. Under such conditions, and in the absence of a whole-of-administration promotion system, local climate action becomes marginalized and fails to advance at the scale required for achieving net-zero.

Adding to the inadequacy of internal policy promotion is the lack of cooperation between peer municipalities on larger-scale action, both spatially and jurisdictionally (BT-9). Certain policy areas, such as energy management, waste treatment, or transport infrastructure, extend beyond the authority or capacity of a single municipality and therefore require coordinated efforts across wider jurisdictions. Yet respondents noted that such cooperation remains limited. This challenge is particularly acute for smaller or remote communities, such as island municipalities, which often depend on mainland neighbors for energy supply, transport links, and other shared utilities.

Related to this, *effective vertical coordination among national, regional, and local governments* emerged as a critical challenge (BT-10). Respondents highlighted misalignments in perception and responsibility across the different levels of government. Some local officials criticized national strategies as “one-size-fits-all,” failing to account for specific local contexts. Others

argued that, under the banner of “giving discretion to local governments,” upper echelons have effectively offloaded responsibility to municipalities without providing the resources or guidance needed to carry it out. Officials further stressed that when climate action is left primarily to local governments—already constrained in terms of budgets and staff—the overall scale of impact will remain insufficient, leading to outcomes that are suboptimal and largely symbolic. The system currently in place at national and prefectural levels was therefore described as highly inadequate. This barrier also overlaps with frustrations voiced under BT-1 regarding financial support: while municipalities face high upfront costs and limited fiscal space, subsidy and support systems remain narrow and underfunded. Smaller municipalities noted that existing arrangements mainly benefit larger, more capable peers, leaving them behind. In addition, respondents expressed strong dissatisfaction with prefectural governments, pointing to their passive stance at times when prefecture-wide coordination is badly needed to bridge gaps in local capacity. Taken together, these dynamics produce a situation of unequally distributed responsibilities and resources, in which local governments are expected to act without adequate support, while higher-level governments remain passive—resulting in climate action that is piecemeal, symbolic, and insufficiently scaled.

Finally, a consistently emphasized challenge within this category was the need to engage stakeholders in climate action—both for consensus-building and for participation in implementation, including independent voluntary action by residents and businesses (BT-11). Respondents acknowledged this necessity, noting that industrial and residential sectors account for a large share of municipal emissions. Yet they also stressed that building consensus is difficult because of the diversity of stakeholder interests, while active involvement in climate measures is unlikely without appropriate incentives.

The enabler themes largely mirrored the barriers, reflecting officials’ views that overcoming these obstacles is itself the key to progress. In their responses, they described how turning these shortcomings into strengths would provide the essential enabling conditions for advancing municipal net-zero policies. Specifically, they pointed to the value of cultivating a shared vision and ownership of climate policy across the administration (ET-10), strengthening cross-departmental cooperation (ET-11), building collaboration with neighboring municipalities (ET-12), achieving stronger vertical alignment with higher levels of government (ET-13), and fostering broader stakeholder engagement, including the private sector (ET-14, ET-15).

The first enabler theme highlights the importance of ensuring that climate concerns permeate the consciousness and operations of the entire local administration, including divisions not directly tasked with climate or environmental policy (ET-10). A broad-based understanding of climate change and the necessity of local action across municipal staff fosters a stronger sense of ownership, with several benefits. It supports better coordination among departments—helping to

break down siloed approaches to policy¹⁴—and mitigates the problem of frequent staff rotations, which otherwise impede the accumulation of specialized expertise (see also Section 5.4.3.2). When all staff share a common baseline of climate awareness, the administration retains continuity despite such transfers. Moreover, mainstreaming climate across the administration enhances the public image of the local government as a leader on climate action, which in turn inspires confidence among residents and businesses and lowers barriers to broader stakeholder engagement. A few responses offered suggestions for how such administration-wide mainstreaming might be achieved. Some pointed to the importance of appointing capable and enthusiastic staff in climate departments who could act as internal champions, spreading awareness across the organization. Others emphasized that such efforts must be supported by empowering climate divisions with sufficient authority and resources to lead. Additional measures mentioned included assigning climate liaisons within other departments and establishing cross-sectional working groups that convene experts from different fields to plan integrated climate responses.

A closely related theme emphasized the enabling role of effective cross-departmental cooperation, which allows different sectors to pool their authorities and capacities (ET-11). Strong horizontal connections across departments were seen as essential to avoid a siloed approach, where climate policy remains confined to a single division and the overall effort is marginalized, as highlighted in the barriers. Respondents described cross-departmental cooperation as crucial for integrated action, where combined resources, expertise, and mandates strengthen the impact of climate measures and help overcome entrenched silos. Concrete examples include projects such as zero-emission buildings (ZEBs) or renewable energy facilities, which inherently require collaboration between construction, energy, and planning divisions. In this sense, enhancing horizontal coherence across municipal departments was regarded as a substantial enabler of effective local climate policy.

Another enabling theme highlighted the importance of cooperation between municipalities, particularly within the same prefecture (ET-12). Such collaboration was seen as a way to pool resources and capacities, thereby achieving broader impacts across a wider spatial scale and bridging the gaps that a single municipality could not overcome on its own. Respondents noted that inter-municipal cooperation is especially valuable for smaller or less resourced municipalities, which often struggle to meet the requirements of complex climate projects by themselves. Some officials pointed to practical examples already underway, such as joint applications for region-wide subsidy programs—including the Ministry of the Environment’s designated Decarbonization

¹⁴ ET-10 represents one empirically grounded component of addressing siloed governance—fostering shared climate awareness across the administration. It does not constitute a complete solution. A more systemic treatment of how siloed governance can be addressed through interacting enabling pathways is developed later in the Integrated Heuristic Model (Chapter 7).

Leading Areas (DLAs)—that allow neighboring municipalities to act collectively and secure funding for ambitious projects.

The theme of effective vertical cooperation across government levels was also emphasized as a crucial enabling condition (ET-13). Respondents argued that climate action cannot be treated as the sole responsibility of local governments and called for stronger coordination with national and prefectural authorities. Such collaboration was seen as essential for reducing fragmentation and ensuring more holistic action with stronger impacts. Officials cautioned against offloading responsibility entirely onto municipalities, stressing the need for upper-level governments to take a more proactive role in bridging local capacity gaps. Within this, the coordinating role of prefectural governments was highlighted: respondents pointed out that prefectures are uniquely positioned to facilitate collaboration among municipalities within their jurisdiction and to drive prefecture-wide initiatives. This theme also connects closely with ET-12, as both stress the importance of integrating municipal action into broader regional frameworks.

The final two interrelated enabling themes in this category concern stakeholder engagement—both in terms of consensus-building (ET-14) and active participation in implementation (ET-15). Although building consensus with diverse stakeholders is complex, as noted in the barriers, respondents emphasized that it is indispensable for fostering broad-based, unified action toward net zero (ET-14). Stakeholder engagement was described as a necessary foundation for diffusing responsibility across multiple actors and generating momentum beyond municipal government alone. Several municipalities reported efforts to create platforms for dialogue, opinion exchange, and awareness-building, such as *kyougikai* (promotion councils) and others. As one respondent explained:

...we will foster momentum for measures against global warming in the city by creating a place for dialogue with various stakeholders, including the youth who will lead the next generation, and by creating a mechanism for building and sharing a decarbonized lifestyle image...

Ultimately, many local governments emphasized the need for the private sector to be actively involved in climate action, seeing this as a highly conducive factor for achieving net zero (ET-15). Respondents noted that engaging industrial actors and the residential sector is particularly critical, as these account for a large share of local emissions. Public–private partnerships were cited as an important mechanism for fostering such involvement, alongside efforts to spread awareness and encourage independent action among businesses and residents—rather than leaving them to wait passively for government initiatives. One strategy highlighted was to collaborate with stakeholders on concrete local issues, thereby linking climate action to concerns that resonate within the community. By aligning climate measures with local objectives, municipalities can

strengthen consensus, enhance the feasibility of implementation, and generate multiple co-benefits, such as socio-economic revitalization and demographic stabilization.

In sum, the themes of institutional coherence and actor coordination highlight that fragmented organizational systems, limited cooperation, weak vertical alignment, and difficulties in stakeholder engagement are widely recognized challenges that must be addressed to create an enabling environment for net-zero action. Respondents emphasized that overcoming these barriers—and turning them into enablers—will require stronger internal coordination within administrations, more robust collaboration across municipalities, more effective vertical coordination between local, prefectural, and national levels of government (particularly with more proactive support from the latter two levels), and deeper engagement of local stakeholders, including the private sector. By advancing on these fronts, local governments can build the organizational and cooperative systems needed to move beyond fragmented efforts and toward broader, more impactful climate action.

5.4.3.4 Political Will And Leadership (BE4.1–BE4.4; B4.5): How Leadership and Awareness Enable Momentum for Net-Zero (BT-13–BT-17; ET-16–ET-24)

This category addresses the themes of political will and leadership, focusing on the extent to which local climate action depends on committed leadership, the capacity to mobilize consensus, and the level of climate awareness across administrations and society. The qualitative responses highlight how both strong champions and a supportive political environment are viewed as essential conditions for sustaining momentum toward net zero.

Quantitative results revealed an asymmetric outcome between barriers and enablers in this category (see Figures 4.5 and 4.9). The facilitating role of climate champions was ranked as the top enabler, yet the absence of such champions was not perceived as a top barrier. The open-ended responses help explain this pattern. On the barrier side, officials lamented the lack of resolute, top-down leadership by chief executives and mayors in advancing climate policy (BT-12). They pointed out that, given the multiple capacity and organizational challenges municipalities face on the path to net zero—such as fragmented cooperation, limited financial and human resources, coupled with incomplete data for policymaking and the absence of immediate policy effects—there are severe limits to what can be achieved solely through bottom-up efforts at the working level. In this context, respondents called for stronger political leadership from municipal heads, noting it has been deficient under what some described as “unstable political and economic circumstances.”

By contrast, when considering the enabling qualities of climate champions, officials highlighted multiple ways in which individual leaders can help advance net-zero efforts. Specifically, three clear enabling roles emerged: (1) raising awareness and encouraging stakeholder engagement (ET-16), (2) fostering internal consensus within the city administration, leveraging their authority

and decision-making weight (ET-17), and (3) articulating an attractive and convincing vision for the community's future, setting direction toward it, and ensuring that priorities and responsibilities are appropriately defined (ET-18).

Leaders' enthusiasm and personal commitment were described as powerful drivers of stakeholder awareness, helping to build stronger support and cooperation from businesses and residents (ET-16). In this respect, several responses also highlighted the value of climate champions emerging from the private sector, complementing the more traditional role played by political leaders such as mayors.

A second enabling role of municipal heads lies in their ability to foster internal consensus within the administration (ET-17). Given their authority over final decisions on budget and personnel allocations—always scarce and contested—the leadership of chief executives is seen as crucial to ensuring that adequate capacities are directed toward local climate objectives. As discussed earlier, achieving administration-wide consensus and cross-departmental cooperation is far from straightforward. Respondents noted that decisive top-down leadership by mayors or chief executives can lower these hurdles significantly. Champions who are able to articulate the synergies between climate action and broader local goals (such as revitalization) further strengthen this consensus-building role by framing climate policy as a local development issue rather than a stand-alone agenda.

A third enabling quality concerns leaders' capacity to envision and communicate a compelling future for the municipality that includes net zero as a central element (ET-18). Respondents emphasized that having such a vision allows leaders to set clear direction, targets, and responsibilities for its achievement. To be effective, however, this vision must be underpinned by a degree of knowledge and expertise that demonstrates both the importance and the feasibility of net-zero goals. Leaders who can present a convincing long-term vision, supported by practical reasoning, were seen as creating an environment in which climate policies can gain traction and move forward.

Taken together, these roles—raising awareness, fostering internal consensus, and envisioning a credible future—illustrate why climate champions emerged as the most important enabling factor in this category. At the same time, the barrier side of this issue was framed more narrowly, focused mainly on the absence of resolute top-down leadership. Unlike the broad range of enabling qualities attributed to champions, this lack of leadership was not evaluated as one of the most severe challenges, helping to explain the asymmetry between barrier and enabler rankings in this category.

The next set of themes concerns the leadership of higher-level government echelons. Respondents repeatedly criticized the guiding and advisory role of national and prefectural governments as highly insufficient—some went as far as to describe it as “almost non-existent”—thereby

hindering local action efforts (BT-13). Officials explained that, so far, the only meaningful interaction between local and upper levels has been in the context of subsidy applications. While national and prefectural governments provide funding for approved projects, they offer little in the way of consultation, advice, or feedback. Several respondents even noted the absence of any consultation forum where local governments could raise concerns or receive guidance. Under such neglect, progress depends largely on municipalities that already have the capacity to act independently, while those with weaker capacities fall further behind.

Closely related, but from a different angle, municipalities criticized the passivity of upper-level political leadership in devising strategic direction and implementing large-scale climate policies (BT-14). Respondents argued that national and regional governments have not been proactive enough in earmarking funds for local needs or in developing broader technological solutions that could support municipal transitions. Without stronger leadership from above, local governments felt that their efforts remain piecemeal and constrained.

The enabling role of upper governments was described in two complementary strands: a steering/guiding role (ET-19) and a technical/instrumental role (ET-20). Under the former one, respondents emphasized that national and prefectural governments should provide a compelling long-term vision, set the path forward, and motivate municipalities to act. Such visionary leadership would help overcome the short-termism that often dominates local policy—favoring symbolic or “no pain” measures—and would provide municipalities with the confidence and legitimacy to pursue more ambitious actions.

In the latter strand, respondents highlighted the need for a comprehensive promotion system at the upper levels that supports local climate policy in concrete terms. Rather than vague calls to create action plans, this system should provide specific advice, practical guidance, and a menu of best-practice measures. Enhanced financial support was also regarded as critical, particularly given the persistent fiscal constraints of municipalities. In addition, respondents pointed to the importance of upper-level leadership in developing technological solutions and reforming sectoral policies in areas such as energy and transport. This broader jurisdiction and higher authority of national and prefectural governments also link directly to the issue of vertical alignment discussed earlier (see Section 5.4.3.3). Respondents emphasized that coordinated region-wide action and tighter alignment of jurisdictions—such as national energy policy and regional utility infrastructure—require more proactive political and technical leadership at higher levels. Only by taking on this role can upper governments ensure that local climate action is scaled effectively and supported in ways that go beyond symbolic measures.

While leadership from municipal champions and upper-tier government is critical, a conducive environment for climate policy and politics should also exist at the constituency level. Without it, climate policy risks being sidelined by the everyday concerns that dominate local

politics (e.g., childrearing, welfare, or healthcare), which often gives an offramp to politicians to disengage from other ambitious policy commitments, such as active promotion of zero-carbon policies. One respondent pointed to citizen surveys showing that while the environment is widely regarded as “important,” it is nevertheless perceived as a low priority, hence it is not treated as a priority by policymakers either (BT-15).

Two enabling themes were identified as ways to build consistency and continuity of climate policy on the local agenda. The first emphasizes the role of long-term awareness-raising through education and the cultivation of a city’s environmental history and legacy (ET-21). By drawing on a sense of environmental heritage and previous actions, municipalities can elevate policy standards and set more ambitious targets. The second enabling theme stresses the importance of political continuity and the recognition of synergies between climate policy and other local objectives (ET-22). Respondents noted that, even with changes in elected leadership, policy momentum can be sustained if climate action is consistently framed as synergistic with broader community priorities and if incoming leaders adopt and extend the initiatives of their predecessors. While related to the enabling roles of individual climate champions (ET-16–ET-19), the emphasis here is not on personal leadership but on the institutionalization of climate priorities across political cycles.

A final set of themes concerned the awareness level in both civil society and within city hall. One barrier frequently mentioned was the low level of awareness among residents (BT-16). Respondents explained that limited concern among citizens translates into weak political demand for climate policy, leaving municipal leaders with little pressure to act proactively. At the same time, even when awareness exists, it often fails to translate into concrete behavior change, such as adopting more climate-friendly lifestyles. Several officials reflected on this gap between knowledge and action, noting that civil society actors often acknowledge the importance of climate change in principle but stop short of altering everyday practices. One respondent poignantly observed that every actor group—residents, businesses, and governments at all levels—tends to see climate change as *someone else’s problem*, expecting others to act first and thereby avoiding responsibility themselves.

On the enabler side, two distinct themes emerged. The first highlights the importance of fostering positive community sentiment toward climate action (ET-23). This goes beyond raising awareness of climate impacts to cultivating a sense of ownership and pride in the municipality’s zero-carbon initiatives. A number of responses pointed to the value of listening to residents’ inquiries and ideas, which sometimes reveal nuanced concerns—for example, the unchecked deployment of mega-solar facilities in sensitive areas such as forests or farmland. Such cases risk damaging the reputation of renewable energy projects and reflect the lack of consultation with communities in the decision-making. In this way, the importance of having an ongoing dialogue

with residents to build shared understanding and support emerged as an important topic in the open-ended response data. Indeed, as some respondents warned, without broad community backing, the necessary investments for climate projects will not be mobilized.

Relatedly, some respondents emphasized that independent voluntary action by residents and local actors is indispensable for municipal climate action (ET-24). Many pointed out that the residential sector accounts for a large share of local emissions, meaning that widespread lifestyle shifts—such as conserving energy, adopting low-carbon transport, or reducing household waste—are necessary complements to formal policy measures. Because local governments face inherent limits in staff, budgets, and authority, a cohort of officials highlighted that progress toward net zero depends on bottom-up engagement that diffuses across society. When citizens act independently, the overall impact multiplies beyond what municipalities can achieve alone, creating a “mass effect” that amplifies mitigation. For these reasons, fostering community-driven, voluntary initiatives was consistently described as one of the most promising enablers of local decarbonization.

Finally, some respondents emphasized that for effective climate action, it is not only community awareness that must be fostered, but also climate awareness within city hall itself (BT-17). This was described as especially challenging, as low levels of climate consciousness among municipal administrations emerged as the top-ranked barrier in the quantitative survey results (see Figure 4.5). Qualitative comments highlighted that municipal governments—policymakers, city employees, and both appointed and elected leaders—must first possess sufficient climate awareness before they can credibly address many of the issues discussed above, such as fostering whole-of-government cooperation, achieving policy cohesion, or engaging external stakeholders. The corresponding enabler was not included in the survey, as its subjective nature made it inappropriate to ask officials to evaluate their own awareness. Nevertheless, several responses acknowledged that climate policy departments—who were themselves the main respondents to the survey—carry a particular responsibility to lead outreach and internal communication, thereby raising the overall level of awareness across the administration.

In sum, the themes under political will and leadership reveal that weak top-down direction, insufficient higher-level guidance, short-term constituency politics, and low awareness among both citizens and city hall staff constrain climate action, while the enabling themes identified shed light on how municipalities perceive the kinds of supportive conditions that can reduce or offset such constraints. Respondents pointed to the crucial role of climate champions in raising awareness, building consensus, and articulating compelling visions; the need for proactive national and prefectural leadership in steering and supporting local initiatives; the importance of political continuity and synergy recognition for sustaining momentum across electoral cycles; and the value of cultivating awareness and voluntary engagement among both communities and municipal

employees. Together, these insights underline that leadership—whether individual, institutional, or societal—creates the environment that determines whether climate policy remains marginal or becomes embedded as a consistent and legitimate priority at all levels of governance.

5.5 Conclusion

This chapter set out to complement the quantitative survey findings presented in Chapter 4 by examining the open-ended explanations provided by municipal officials. Its purpose was to uncover the interpretive reasoning underlying municipalities' judgments of the most salient motivations, barriers, and enablers toward net zero, thereby addressing the crucial “why” dimension often absent in closed-ended surveys. To achieve this, I employed thematic analysis of nearly 1,000 open-ended responses collected through a carefully structured, stepwise survey design. This design conditioned respondents to move from simple evaluations to forced prioritization and, finally, to short but meaning-rich written justifications, yielding a dataset that was both rich in content and unusually focused for qualitative material.

The analysis produced 66 themes across motivations, barriers, and enablers. Together, they provide a comprehensive mapping of the rationales that shape local climate action in Japan. Read alongside the quantitative results, the themes illuminate not only why municipalities ranked certain factors as most important, but also how these judgments are situated within broader fiscal, social, and political realities. Importantly, the qualitative analysis was not confined only to those factors that dominated the top ranks in the quantitative analysis (as determined in Chapter 4); instead, all themes that emerged from respondents' open-ended reasoning were given equal weight. This ensures a fair treatment of the material and reveals connections that might otherwise be lost—for instance, where rationales linked to less frequently selected factors overlap with those of highly ranked ones, or where quantitative survey items constrained respondents' expression but their written elaborations provided richer nuance.

This approach makes several contributions. First, it demonstrates the value of applying qualitative thematic analysis to a large-N survey sample—309 municipalities—an approach rarely used in this field. Typically, qualitative richness is sought through in-depth case studies or interviews, while large-N designs are reserved for quantitative generalizations. Here, the stepwise survey structure generated concise yet substantive qualitative data from a large-n municipal sample, combining both depth and generalizability. Second, the analysis offers a systematized overview of motivations, barriers, and enablers (MBEs) within a single study, avoiding the fragmentation of knowledge that often requires subsequent systematic reviews or meta-studies. Third, by synthesizing municipal officials' free-text reasoning, the analysis highlights not only the salience of individual factors but also the interconnections between them—for example, how economic motivations in a big way are shaped by the current fiscal constraints, or how enablers related to climate

champions' leadership can help overcome weaknesses of institutional character. Fourth, the study also enhances responsiveness to participant input: by treating open-ended responses as stakeholder voices, reported through quotes and synthesized rationales, it validates participants' perspectives and makes findings more relatable, transparent, and actionable for practitioners. Together, these contributions provide not only a map of municipal reasoning but also a grounded and practically relevant resource for understanding local climate governance. Finally, because each theme is tied to the analytical framework developed through the literature review, the chapter also offers a way to re-contextualize existing research insights through the lens of municipal officials' reasoning.

Beyond complementing the quantitative findings, the thematic analysis plays a crucial bridging role in the overall architecture of this dissertation. Whereas Chapter 4 identified which motivations, barriers, and enablers were most salient, Chapter 5 uncovers the interpretive logic through which municipal officials connect these factors in practice. It is through this qualitative layer that relational patterns and feedback dynamics became visible, ultimately informing the development of the Integrated Heuristic Model in Chapter 7. Without the thematic analysis, the final synthesis would risk remaining a structured aggregation of ranked factors; with it, the model is grounded in empirically observed reasoning about how MBEs condition and reinforce one another.

At the same time, several limitations should be acknowledged. The thematic analysis is purely qualitative and deliberately does not attempt to tie responses to variable-based characteristics such as municipality size, type, or location; responses were anonymized and interpreted on their own terms, purely on the basis of their qualitative contents. This limitation, however, can also be seen as a feature: it allows the focus to remain on the reasoning itself rather than conflating it with external variables. The analysis also operates at a meso-level. It does not provide the fine-grained contextual depth of individual case studies, nor the sweeping generalizations of meta-analyses or hypothesis-testing of quantitative studies. Instead, it balances between the two, offering a kaleidoscopic set of rationales that, when pieced together, provide a holistic picture of municipal climate governance. Finally, because of the breadth of material, space did not allow for in-depth discussion of each theme; the intention here was to provide a broad mapping, while recognizing that each theme could be elaborated in greater detail and situated more deeply in the literature.

These limitations open the door to future research. The rich set of themes offers fertile ground for generating hypotheses, testing relationships, and pursuing deeper inquiries into specific issues. Case studies, comparative research, or mixed-methods designs could build on these findings to explore particular mechanisms in more detail. Themes that appear overlapping or closely related could be synthesized into meta-themes, while others invite investigation into causal

pathways, institutional arrangements, or communication strategies.¹⁵ In this way, the present chapter provides not only a map of current reasoning but also a platform for further theoretical and empirical work.

To conclude, local governments' salient motivations, barriers, and enablers toward net zero cannot be understood solely through quantitative measurements. The qualitative themes reveal a kaleidoscope of perspectives that explain why certain factors matter, how they potentially interrelate, and how they are embedded in the everyday realities of municipal governance. By giving equal attention to all open-ended responses, the analysis provides a fuller and more balanced picture of municipal climate action—one that respects the complexity of local reasoning while offering insights of generalizable value.¹⁶

¹⁵ Chapter 7 largely addresses this future research direction.

¹⁶ A degree of generalizability is enabled by the large sample and considerable response data

Chapter 6. Bridging Academic and Societal Knowledge Creation: Transdisciplinary Activities

6.1 Introduction

Chapter 2 provided a comprehensive review of the literature to identify and synthesize the factors most commonly recognized as motivating, obstructing, and facilitating local climate action. Based on this review, I developed an integrated analytical framework combining these three concepts—Motivations, Barriers, and Enablers (MBEs)—and compiled corresponding factor lists within each category. This framework informed the design of the questionnaire survey used to systematically collect data from 489 net-zero-committed municipalities across Japan, as detailed in Chapter 3. Then, Chapter 4 presented the quantitative results, showing which MBE factors were evaluated and prioritized as most salient by municipalities striving toward net-zero goals. Chapter 5 then complemented these findings through thematic analysis of open-ended responses provided by municipalities that elaborated on their answers with contextual explanations and reasoning. This qualitative analysis revealed recurring themes that illustrated how municipalities rationalize and emphasize particular MBEs, thereby enriching the understanding of the dynamics underpinning local climate action.

These three strands of contribution—a comprehensive literature synthesis (the integrated framework) and both quantitative (MBE rankings and correlations) and qualitative (thematic) analyses—together demonstrate the *interdisciplinary* character of this research. The study is interdisciplinary in two main respects. First, the inquiry and synthesis of knowledge on local climate governance drew on multiple academic fields, including public administration, political science, institutional economics, sociology, psychology, environmental policy, and urban sustainability. Second, the research adopted a mixed-methods design, combining quantitative and qualitative approaches to collect data (through both closed- and open-ended survey questions) and to analyze it using descriptive statistics, correlation analysis, and thematic analysis.

The thesis now turns to the efforts undertaken to *transcend* the traditional boundaries of academic inquiry—that is, to move toward *transdisciplinary* research. In doing so, I aim to contribute not only to research that integrates multiple disciplines (as in interdisciplinarity) but also to approaches that bridge the divide between academia and practice and reconsider the role of the researcher. The first aspect involves producing knowledge *with* municipalities and stakeholders rather than merely *about* them, while the second entails adopting *action-oriented* roles as a sustainability researcher engaged in participatory, process-focused research aimed at supporting societal transformation toward sustainability.

This chapter proceeds by outlining the theoretical foundations of *transdisciplinarity* (Section 6.2), describing its practical application through participatory activities (Section 6.3), reflecting on and integrating these experiences into a framework for operationalizing transdisciplinary learning (Section 6.4), and concluding with summary reflections and limitations (Section 6.5).

6.2 Theoretical Framing of Transdisciplinary Inquiry

The notion of *transdisciplinarity* has gained prominence in sustainability science as scholars and practitioners grapple with the complexity of climate change and other “wicked problems” that cannot be adequately addressed through disciplinary or even interdisciplinary approaches alone. Whereas “*inter*”-disciplinarity emphasizes integration across academic fields, “*trans*”-disciplinarity is generally understood as a mode of research that deliberately transcends the boundaries of science, engaging with societal actors and aiming at transformative change.

Ortwin Renn (2021) provides one of the most comprehensive contemporary syntheses of the concept, proposing a “modular understanding of transdisciplinary science” that integrates three research traditions: (I) *curiosity-driven* research, (II) *goal-oriented* research, and (III) *catalytic* research. The first corresponds to classical academic inquiry motivated by the intrinsic pursuit of knowledge; the second is problem- or mission-oriented research designed to generate knowledge for policy or societal goals; and the third, catalytic research, emphasizes the facilitation of participatory processes, collective learning, and knowledge co-production across science and society. Renn characterizes the mission of transdisciplinary science as “building bridges between knowledge and collective action”, a task made possible when research integrates these three traditions. In his framework, transdisciplinary inquiry combines three types of knowledge: *factual* knowledge (from curiosity-driven science), *strategy-oriented* knowledge (addressing complex or wicked problems and informing policy strategies), and *process-related* knowledge (aimed at deliberative discourse and participatory co-production). According to Renn, when pursued together, these forms of knowledge can lead to solutions that are “factually convincing, argumentatively consistent, morally substantiated, and, in principle, acceptable to all” (Renn, 2021). In the structure of this dissertation, the earlier chapters primarily addressed the *factual* and *strategy-oriented* dimensions, while the present chapter turns to the *process-related/catalytic* aspect.

Christian Pohl (2011) likewise highlights the progressive movement from *multi-* to *inter-* to *trans-*disciplinarity, and presents the literature consensus on the four core features of the latter: (1) relating to socially relevant issues, (2) transcending and integrating disciplinary paradigms, (3) participatory research, and (4) searching for a unity of knowledge. However, Pohl also criticizes these literature-consensus-based definitions as remaining at the level of “tools,” such as merely calling for participatory design and/or disciplinary integration, without mentioning purposes and guiding principles from the researchers’ perspective. Practically speaking, according to Pohl

(2011), to make a socially relevant and practically useful transdisciplinary contribution, a researcher should: (a) “*grasp the complexity*” of the issue at hand; (b) to “incorporate diverse perspectives”, acknowledging the plurality of viewpoints and contexts involved; (c) to “connect abstract, theoretical insights with case-specific and practical knowledge,” ensuring that general frameworks remain grounded in local realities; and (d) to “develop knowledge that is not only descriptive but also normative and action-oriented,” thereby promoting the ‘common good’ perspective through joint knowledge development. These four practical purposes move the discussion of transdisciplinarity from a checklist of methodological attributes toward a researcher-centered compass. They underscore that transdisciplinary research lies not simply in the use of participatory instruments and the integration of disciplines, but in orienting inquiry toward complexity, plurality, integration of scales, and common-good-oriented knowledge production (Pohl, 2011).

It must be noted, however, that both Renn and Pohl were fully aware of the Herculean task facing the individual researcher pursuing transdisciplinary research. Pohl (2011) says: “The four purposes will only be accomplished in the ideal transdisciplinary research process, taking place in heaven.”; instead emphasizing them as a “heuristic tool” and a practical “compass” (Pohl, 2011). Similarly, Renn (2021), while advocating the three-orientations (curiosity-driven, goal-directed, and process-related) synthesis approach, warns that: “A unified transdisciplinary research concept has also been criticized as putting too many demands and requirements on the shoulder of individual scholars,” especially excessive in the context of early-career researchers (Renn, 2021).

In light of these precautions, my own work represents an attempt at transdisciplinarity rather than strict compliance with all its aspects. I recognize that the ideal set out by Pohl and Renn may be hardly attainable, yet I have nevertheless pursued a variety of efforts in this direction. For instance, the framework synthesis and large-scale survey presented in earlier chapters already address several of Pohl’s guiding purposes: they (a) engaged with the complexity of municipal climate governance, (b) incorporated the diverse perspectives of hundreds of local governments, and (c) connected abstract conceptual (literature-derived) understanding with case-specific empirical data. Yet one key dimension remains only partially met: (d) the development of normative and action-oriented knowledge through *participatory co-production*, directed toward the common good. It is precisely this dimension that aligns with Renn’s (III) catalytic orientation and with Pohl’s features of transdisciplinarity: (3) participatory research and (4) the search for unity of knowledge (Pohl, 2011; Renn, 2021). Addressing it requires examining the process-oriented roles that researchers may assume when actively engaging in knowledge co-production and societal learning—roles that extend beyond analytical observation to facilitation, brokerage, and catalytic action.

In this light, it is useful to turn to literature that explores the possible roles of a sustainability researcher in processes of knowledge co-production with societal actors. Pohl et al. (2010)

identified three prototypical roles that researchers intuitively adopt: *the reflective scientist*, who ensures disciplinary rigor and methodological soundness; *the intermediary*, who moves between scientific and non-scientific ‘thought-styles’ to translate and connect perspectives; and *the facilitator* of joint learning processes, who creates the conditions for dialogue and mutual exchange. Together, these roles highlight that transdisciplinary inquiry requires researchers to extend beyond detached analysis, taking on relational and process-oriented responsibilities that support co-production and collective learning (Pohl et al., 2010).

Building on this early typology, Wittmayer and Schöpke (2014) extended and proposed a more systematic account of ideal-type researcher roles in process-oriented sustainability science. They contrast this “process-oriented” approach with more conventional “knowledge-first” perspectives, in which the scientist’s role is largely confined to providing knowledge. In the process-oriented view, however, this role extends further to include establishing, facilitating, and actively participating in dialogues for change. They particularly emphasize the tradition of *action research*, which they understand as the collaborative production of knowledge and action, aimed at fostering societal learning and enabling transformative change (Wittmayer & Schöpke, 2014).

From this process-oriented action research vantage point, Wittmayer and Schöpke outline five ideal-type roles that researchers may adopt. (i) The *reflective scientist* remains closest to the conventional academic role, providing disciplinary rigor and systematic analysis, yet in transdisciplinary settings, this role must be balanced with others. (ii) The *knowledge broker* mediates between different perspectives (‘thought-styles’ in Pohl et al.’s (2010) conceptualization), helping to translate insights across boundaries and to make them meaningful in new contexts. (iii) The *process facilitator* is responsible for shaping and maintaining the participatory arenas in which societal learning can take place, ensuring inclusivity and constructive interaction. Beyond these relational and process-oriented functions, (iv) the *change agent* represents the most explicitly action-oriented role, as researchers may contribute directly to initiating or supporting interventions that catalyze transformation. Finally, (v) the *self-reflexive scientist* underscores the importance of critical awareness—acknowledging one’s own values, positionality, and influence within the process itself (Wittmayer & Schöpke, 2014).

As summarized in Table 6.1, the frameworks reviewed above can all be positioned within a big-picture view of transdisciplinarity, ranging from broad ‘orientations’ (Renn, 2021) and ‘heuristic purposes’ (Pohl, 2011) to the more operational ‘researcher roles’ (Pohl et al., 2010; Wittmayer & Schöpke, 2014).

Table 6.1. From General Orientations to Researcher Roles: Situating the Research Activities within Transdisciplinarity Frameworks

Level	Frame- work	Key Elements	Relation to Next Level	Correspondence to Activities Undertaken in the Current Study
General orienta- tions of transdis- ciplinary research	Renn (2021)	(I) Curiosity-driven → factual knowledge; sys- temic perspective (II) Goal-oriented → strategy-oriented knowledge; toward complex real-world prob- lem (III) Catalytic → process-related; inclusion of non-scientific knowledge; co-production	Transdisciplinarity is seen as integrating the three research traditions and corre- sponding knowledge types. The cata- lytic/process-related orientation sets the scene for co-productive research dimen- sions and activities	Earlier thesis chapters primarily address (I) and (II) through literature synthesis, survey design, and quantitative/qualitative analysis; this chapter turns to (III), the cata- lytic/process-related orientation
Core features of transdisciplinarity (according to broad literature consensus)	Pohl (2011), citing earlier works	(1) Relating to socially relevant issues (2) Transcending and integrating disciplinary paradigms (3) Participatory research (4) Searching for a unity of knowledge	Specifies essential characteristics of trans- disciplinarity according to broad consen- sus in the literature. Features (3) and (4) correspond most closely to the cata- lytic/process-related dimension identified by Renn.	Features (1) and (2) addressed in frame- work synthesis and survey; features (3) and (4) only partly realized, motivating fo- cus on participatory and action-oriented elements in this chapter
Guiding purposes ("compass")	Pohl (2011)	(a) Grasp the complexity of the issue (b) Incorporate diverse perspectives (c) Connect abstract with case-specific knowledge (d) Develop descriptive, normative, and practi- cal knowledge for the common good	Marks a shift from defining the character- istics of ideal transdisciplinarity toward a researcher-oriented compass, highlighting how researchers should approach prob- lems.	All four purposes (a–d) were addressed to some extent through the integrated frame- work, survey, and mixed-method analysis, but could be reinforced through more par- ticipatory and action-oriented engage- ment.
Researcher roles in knowledge co- production	Pohl et al. (2010) and Wittmayer & Schäpke (2014)	Pohl et al. (2010): Reflective scientist, Interme- diary, Facilitator of joint learning Wittmayer & Schäpke (2014): (i) Reflective scientist, (ii) Knowledge broker, (iii) Process facilitator, (iv) Change agent, (v) Self-reflexive scientist	These roles show how researchers may enact participatory and catalytic aspects in practice (particularly in the sustainability research settings aiming for transitions).	Earlier chapters primarily exhibited the re- flective scientist role. This chapter consid- ers how my efforts also approximated bro- kerage, facilitation, change agency, and self-reflexivity, thereby reinforcing the participatory and catalytic dimensions.

This table positions the different contributions of the author's research within the broader landscape of transdisciplinary research. Renn's orientations (2021) provide a general framework of knowledge traditions, Pohl's features and guiding purposes (2011) specify key characteristics and heuristic aims, and the researcher role typologies of Pohl et al. (2010) and Wittmayer & Schäpke (2014) operationalize the process-related, action-oriented dimension. Taken together, these perspectives map the conceptual terrain of transdisciplinarity, with the last row specifically pointing to the practical, role-based dimensions through which researchers engage in participatory and catalytic work. While earlier chapters of this dissertation correspond to many of the transdisciplinary facets, the present chapter addresses those not yet fully covered—specifically, the catalytic (i.e., participatory, process-oriented) elements linked to the 'researcher roles' in knowledge co-production.

In what follows, I situate my own efforts in relation to these conceptualizations of researcher roles. While the earlier chapters of this dissertation primarily reflected the role of the reflective scientist—developing frameworks, conducting systematic analyses, and presenting empirical findings—this chapter turns to the ways in which I attempted to approximate the more process-oriented roles. These include acting as a broker of knowledge between academic and municipal perspectives, facilitating exchanges and dialogues, and, at times, contributing as a change agent in participatory and catalytic initiatives. Although these activities cannot claim to meet all criteria of transdisciplinary research, they represent deliberate attempts to extend my work beyond analysis and toward engagement in the co-production of knowledge and practice.

6.3 Participatory/Catalytic Research Activities as Part of Doctoral Study

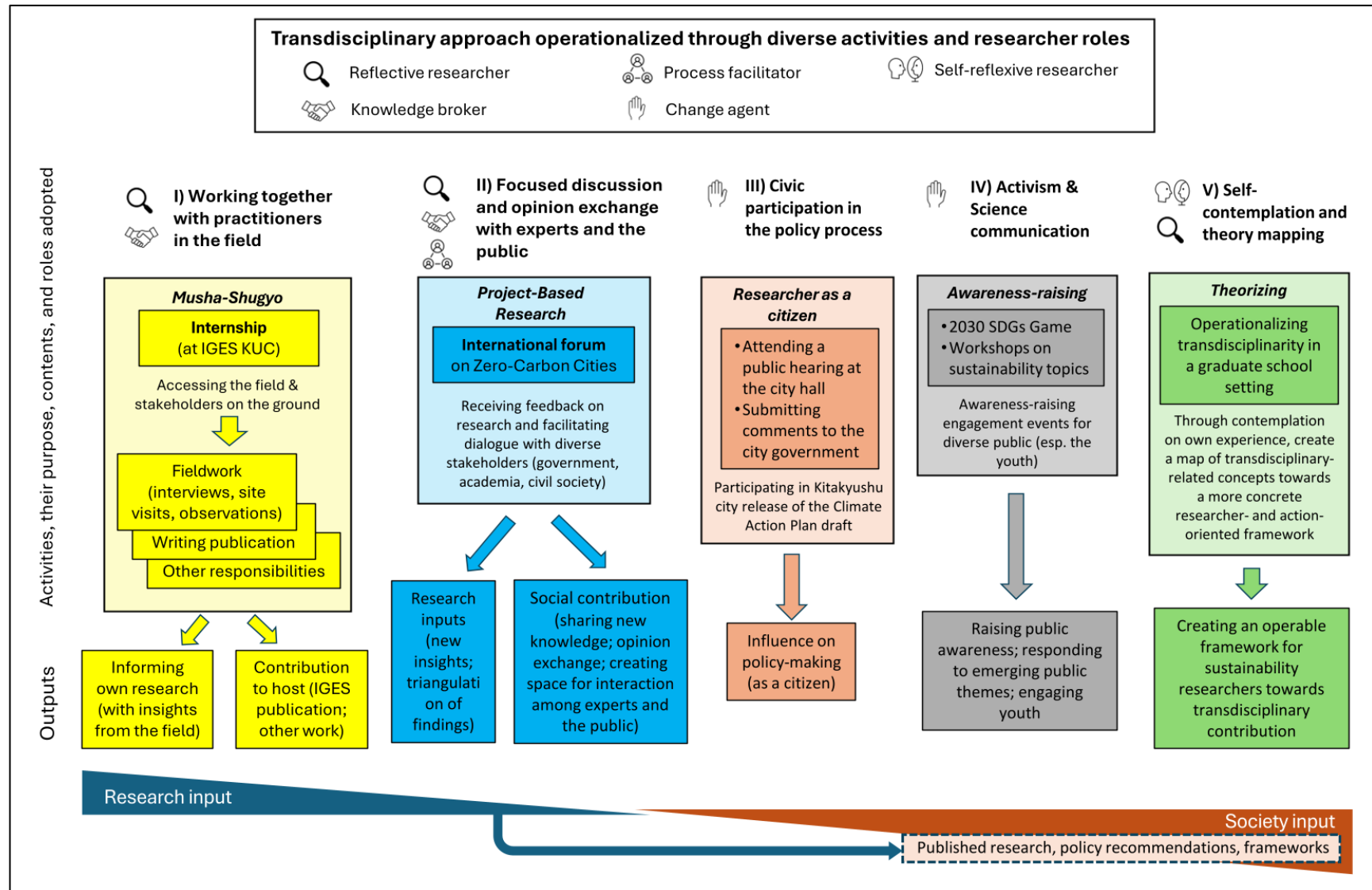
As outlined in Table 6.1, earlier chapters primarily engaged with elements of transdisciplinarity through the conceptual synthesis of the literature and the analysis of the empirical survey. In this section, however, the focus shifts to a different set of activities: those that involved my direct participation in field and institutional contexts, such as internships, organizing stakeholder forums, and other engagement initiatives. These activities are best understood as participatory and catalytic research engagements in the spirit of *action research*,¹⁷ aiming not only to analyze but also to facilitate knowledge exchange, foster collective learning, and contribute to societal change.

Most of these activities were undertaken as part of the distinctive PhD curriculum at the Graduate School of Advanced Integrated Studies in Human Survivability (GSAIS). Drawing on both Western philosophical traditions—particularly recent emphases on inter- and transdisciplinarity—and Eastern ideas such as the Buddhist concept of 聞思修 (*mon-shi-shu*, literally “hearing, thinking, practicing”), the school places strong emphasis on practical engagement. Students are encouraged to step outside academia and participate in society through research-related activities. This philosophy is institutionalized in two key components of the program. The first is 武者修行 (*Musha-shugyo*, literally “knight errantry”): an internship of at least six months in a professional setting relevant to the student’s field of research. The second is Project-Based Research (PBR): the planning, organization, and implementation of a research-related project in collaboration with societal stakeholders such as companies, government agencies, and civil society organizations. Both *Musha-shugyo* and PBR closely align with the transdisciplinary emphasis on transcending academic boundaries, especially its catalytic/participatory dimension. They foster participatory research, knowledge co-production, and action-oriented engagement, thereby positioning the doctoral training at GSAIS as inherently transdisciplinary in both design and practice.

¹⁷ These activities should be regarded as attempts to approximate transdisciplinary practice. While inspired by principles of action and participatory research, they likely do not represent full-fledged applications of those well-established traditions.

The findings and details of the Musha-shugyo and PBR activities are presented in an integrated report—Working Paper (WP)—which is attached as Appendix D to this dissertation. In what follows, I provide a general overview of these activities (Figure 6.1) and situate them within the transdisciplinary framework outlined earlier, highlighting their relevance to participatory research, catalytic engagement, and the enactment of transdisciplinary ‘researcher roles’.

Figure 6.1. An overview of participatory activities towards transdisciplinarity, their outputs, and the roles adopted



Source: Author's elaboration based on the researcher roles framework proposed by Wittmayer and Schöpke (2014) within process-oriented sustainability science.

6.3.1 Internship: Exploring Conducive Background Factors to Net-Zero Cities through Fieldwork in Kyushu

Kyushu was a particularly appropriate region in which to undertake fieldwork, given its historical significance as one of Japan's major industrial centers, its pioneering role in environmental initiatives, and its large number of early Zero Carbon City declarations. Conducting fieldwork in this region allowed me to observe how diverse local contexts—ranging from large designated cities with heavy industrial legacies to rural towns, mountain villages, and remote islands—were interpreting and operationalizing the net-zero agenda. These engagements provided an opportunity to examine the conducive background factors that made such commitments possible and to situate them within wider patterns of subnational climate governance. In addition to informing my understanding of municipal motivations and practices, this immersion embodied the transdisciplinary ethos of field engagement (see Section 6.2), enabling me to build rapport with officials and stakeholders and to refine the later survey design with a more grounded appreciation of the realities faced by local governments.

The Musha-shugyo internship was conducted at the Kitakyushu Urban Centre (KUC) of the Institute for Global Environmental Strategies (IGES), a regional research institute positioned at the interface of academia, local government, and practice. KUC conducts applied research on urban sustainability and climate policy while advising municipalities and prefectures across Japan (IGES, n.d.). Embedding myself in this practical setting for six months provided a valuable opportunity to immerse myself in the field of municipal climate governance while my doctoral research design was still being developed.

This internship, which preceded the implementation of the municipal survey, played an important role in familiarizing me with practical realities, tacit dynamics, and stakeholder networks. Through this immersion, I gained an early understanding of how municipal climate policy is framed and implemented, while also establishing relationships that later proved essential to my research. For example, IGES policy researchers provided feedback on my early survey drafts, and a Kitakyushu City official helped to review the questionnaire's contextual appropriateness and to pilot-test it prior to its finalization.

Qualitative inquiry literature often emphasizes the importance of such early-stage field engagement for ensuring research credibility, as it fosters contextual awareness, rapport, and trust with actors in the field (Lincoln & Guba, 1985). In this sense, the internship strengthened my research design while simultaneously reflecting the transdisciplinary orientation toward immersion, participation, and co-production.

6.3.1.1 Saga and Nagasaki: Municipal and Prefectural Perspectives

Together with IGES colleagues and individually, I conducted 18 fieldwork activities, comprising interviews, site visits, and observations, across several municipalities in Kyushu (see Table D1 in Appendix D). At the time (2020–2021), many of these municipalities had only recently declared their “Zero Carbon City by 2050” commitments. Yet these announcements were grounded in conducive background factors that had already been shaping local climate initiatives and sustainability practices. Through site visits, observations, and discussions with municipal officials, business representatives, and community actors, I was able to explore these existing activities and conditions, and to see how they created a favorable environment for the subsequent uptake and reception of the zero-carbon agenda.

For instance, in Saga City and in Nagasaki City, I interviewed both municipal and prefectural officials regarding their recently made Zero Carbon City commitments. The interviews revealed that the declarations were not spontaneous or standalone. Instead, they were largely perceived as extensions of ongoing climate and environmental plans that municipalities had already developed or were in the process of formulating (and hence, with the net zero declarations, they simply increased their existing ambitions). Municipal officials also emphasized aspirations for co-benefits such as economic revitalization and resilience. Nagasaki officials also noted the influence of Kumamoto’s earlier joint declaration, which had created peer influence in the region.

Engaging with prefectural officials provided additional insights that complemented the municipal perspective. Much of their narrative mirrored what municipal officials emphasized: the declarations were seen as extensions of existing climate plans, though it seemed the national carbon neutrality goal was particularly influential. Prefectural officials also pointed to similar structural challenges—limited staff, fragmented coordination, and difficulties with emissions data—though considered at a larger administrative scale. The fact that their perspectives closely echoed those of municipal counterparts suggests a broad alignment of discourses across subnational governments. While my survey was designed to target municipalities only, these interviews cautiously indicate that many of the themes explored—motivations, barriers, and enabling conditions—are also salient at the prefectural level. In this sense, the internship fieldwork offered an early opportunity to situate municipal perspectives within a wider governance context and to triangulate (albeit retrospectively) the survey findings with a broader subnational scale.

6.3.1.2 Kitakyushu: Historical Legacies, Flagship Projects, and Stakeholder Engagement

My engagement with Kitakyushu City began prior to the internship, during the fieldwork for my research work toward the PhD Qualification Examination (QE) at GSAIS in 2019. At that time, my focus was broader than climate policy: I sought to understand how diverse stakeholders in the city were involved in sustainable urban development more generally, with particular

attention to stakeholder engagement practices. Through 16 semi-structured interviews with representatives of municipal government, academia, industry, and civil society, as well as a week-long participatory observation at the Kitakyushu SDGs Training Programme (organized jointly by the City and KUC), I explored how the city's history of overcoming industrial pollution and its designation as an Eco-Model City and later an SDGs Future City had shaped its sustainability initiatives and collaborative practices.

These conversations revealed both strengths and limitations in the city's sustainability engagements. On the one hand, Kitakyushu had implemented pioneering environmental initiatives—such as the Eco-Town recycling cluster, piloting hydrogen utilization in the steel industry, and other admirable pioneering technology initiatives—while also establishing platforms for stakeholder collaboration, including environmental councils and SDGs-related networks. These efforts helped sustain the city's environmental reputation and facilitated cooperation among government, large industries, and universities. On the other hand, the interviews revealed that engagement often remained top-down and unevenly distributed, with civil society actors and smaller businesses being less consistently integrated into decision-making processes. My major conclusion from this phase of research (submitted as the QE paper at GSAIS) was that Kitakyushu's sustainability governance combined strong institutional leadership and symbolic flagship projects (reinforced by its historical legacy and civic pride) with a continuing need to deepen and broaden participation beyond its traditional industrial and governmental base.

During my subsequent internship at IGES Kitakyushu Urban Centre, I was able to revisit these themes from a more climate-focused perspective, specifically in the context of the city's Zero Carbon City declaration. Together with IGES colleagues, I conducted several additional interviews (including with former government officials, focusing on historical legacies shaping the city's environmental stance) and undertook site visits to the Eco-Town recycling cluster, the Bonjono low-carbon residential district, and Omoyai Farm, a social business inspired by the city's SDGs Future City designation that combines urban agriculture with social inclusion (by employing people with disabilities). I also observed a citizen engagement workshop at the Hibikino Citizen Center, which provided practical training on household composting and encouraged citizens to adopt low-carbon lifestyles. These activities showed how Kitakyushu continues to project itself as an environmental pioneer through technology- and industry-oriented projects, while also experimenting with more participatory approaches to embed sustainability at the community level.

Taken together, my earlier QE fieldwork and the later internship activities in Kitakyushu offered complementary perspectives on the city's role as a sustainability forerunner (Table 6.2). They demonstrated how the city leverages its historical legacy, institutional and economic standing as a designated city with a strong industrial tradition, in order to sustain environmental leadership, while also highlighting persistent tensions between technocratic, industry-led strategies and

aspirations for broader participatory governance. For this dissertation, Kitakyushu serves as a case that illustrates how conducive background factors—historical experience, strong municipal steering, and emblematic projects—created fertile ground and long-term continuity for environmental leadership, eventually culminating in the adoption of a net-zero goal. At the same time, the case underscores that the quality and depth of stakeholder engagement remain a crucial area for further improvement.

Table 6.2. Two phases of fieldwork engagement with Kitakyushu City

Phase of engagement	Period	Activities (No.)	Main stakeholders	Focus of inquiry	Key insights
Fieldwork as part of the research work toward the PhD Qualification Examination (QE)	Three consecutive visits in 2019: Oct 21-29 Nov 11-12 Dec 2-5	Interviews (16); Participatory observation at Kitakyushu SDGs Training Programme (1 week-long).	Municipal officials; Academics; Industry representatives; Civil society actors.	City's sustainability initiatives and governance arrangements, especially stakeholder engagement	Strong institutional leadership and flagship projects; multi-stakeholder platforms established; participation uneven and often top-down; smaller businesses and civil society less integrated
Fieldwork as part of the <i>Musha-shugyo</i> Internship at IGES Kitakyushu Urban Centre	April to November 2021 (presence as intern researcher)	Interviews (3); Site visits (3); Observations (1).	Government officials; NGO representatives; Policy researchers; Social entrepreneurs; Citizens and activists.	Historical background to Zero Carbon City commitment; Local initiatives in low-carbon lifestyles.	Flagship projects (e.g., Eco-Town, Bonjono district, etc.) reinforce environmental reputation; approach remains technology- and industry-oriented; novel SDGs initiatives reflect growing but still limited citizen engagement; confirms earlier observations of top-down dynamics

Source: Author

6.3.1.3 Other Municipalities: Oguni, Morotsuka, Kushima, and Goto

Beyond big cities such as Kitakyushu, Saga, and Nagasaki, I also conducted fieldwork in several other smaller municipalities across Kyushu. These visits were short and exploratory, but each provided useful context for understanding the diversity of conditions shaping Zero Carbon commitments. In Oguni Town (Kumamoto Prefecture), I visited a community-managed small hydropower project, which demonstrated how rural municipalities leverage traditional irrigation infrastructure for renewable energy production and local revenue generation. In Morotsuka Village (Miyazaki Prefecture), I learned about its long-standing system of mosaic forestry and its designation as a Globally Important Agricultural Heritage System (GIAHS), which illustrated how cultural heritage and local resource endowments can be mobilized toward sustainability goals. In Kushima City (Miyazaki Prefecture), I visited an onshore wind power cluster, highlighting how favorable geographic conditions and industrial collaboration had enabled large-scale renewable energy deployment.

My engagement in Goto City (Nagasaki Prefecture) was more extensive. There, I conducted interviews with a range of stakeholders, including municipal officials at city hall, representatives of an electric power company operating Japan’s pioneering floating offshore wind turbines, and a marine research institute investigating the coexistence of renewable energy development with fisheries. These interactions enabled me to observe how a small, remote island municipality was positioning itself as the “Island of Energy,” by combining ambitious renewable energy projects with broader goals of local revitalization. I summarized the insights from these field interviews, combined with complementary desk research, in an IGES publication: a booklet titled “Pathway to a Zero Carbon City: Island of Energy, Goto City” (Myasoedov & Ota, 2021). This fact sheet presents Goto as a pioneering case of local energy transition, documenting its innovative practices such as floating offshore wind, community engagement in renewable energy, and strategies for balancing economic, environmental, and social needs on a geographically constrained island.

Taken together, these engagements in Oguni, Morotsuka, Kushima, and especially Goto provided an opportunity to observe how conducive background factors vary across rural towns, mountain villages, regional cities, and island municipalities. While the scale, resources, and governance arrangements differed significantly, each case showed how local contextual factors create unique pathways toward net-zero, complementing the survey’s insights (Table 6.3).

Table 6.3 Fieldwork activities and insights across Kyushu municipalities

Municipality	Activities conducted	Key focus/initiative observed	Main insight
Oguni Town (Kumamoto Pref.)	Site visit and interview	Community-managed small hydropower project using irrigation channels	Rural municipalities can leverage traditional resource systems for renewable energy, generating local revenue and reinforcing self-sufficiency.
Morotsuka Village (Miyazaki Pref.)	Site visit	Mosaic forestry and long-standing combined agriculture–forestry system (GIAHS designation)	Cultural heritage and ecological practices provide a strong basis for sustainability, but demographic decline poses challenges for continuity.
Kushima City (Miyazaki Pref.)	Site visit	Onshore wind power cluster	Demonstrates how geographic endowments (strong wind conditions) can be mobilized in medium-sized coastal cities
Goto City (Nagasaki Pref.)	Interviews (municipal officials, power company, marine research institute), site visits	Floating offshore wind pilot projects; integration with fisheries and local revitalization strategies	The pioneering case of an island municipality branding itself as the “Island of Energy”; illustrates innovative use of renewable projects for economic revitalization and community engagement. See more details in the publication: “Pathway to a Zero Carbon City: Island of Energy, Goto City.”

Source: Author

6.3.1.4 Summary of the Internship Activities

Taken together, the fieldwork across these municipalities provided an essential complement to the later survey research. The interviews in Saga and Nagasaki highlighted how both municipal and prefectural government perspectives converged around the importance of existing environmental plans in stepping up their ambitions toward commitments to net zero. At the same time, municipal officials tended to emphasize other municipal peers as inspiration, while prefectures seemed to be swayed mainly by the example of the national government announcing its goal of carbon neutrality. Both municipal and prefectural governments raised similar sets of challenges, such as a lack of funds, human resources, complicated and inefficient subsidy schemes, and difficulties with calculating an accurate account of local GHG emissions.

The in-depth engagements in Kitakyushu revealed how a historically industrial city has mobilized its legacy and institutional status to promote environmental leadership, while also exposing the limits of top-down, technocratic approaches to stakeholder engagement. The additional cases of Oguni, Morotsuka, Kushima, and Goto further demonstrated the diversity of pathways toward net zero, shaped by local histories, resource endowments, and socio-economic contexts—from rural small-scale hydropower to forestry heritage, wind clusters, and pioneering offshore projects.

Together, these field experiences illustrate how conducive background factors vary across settings, creating distinct opportunities and constraints for climate action. Beyond generating research insights, the fieldwork embodied the transdisciplinary ethos of immersion and engagement, helping me to build rapport with local actors, refine my survey design, and triangulate (albeit retrospectively) the survey findings.

In terms of the ‘researcher roles’ aimed at transdisciplinary contributions, the internship and fieldwork activities correspond most closely to what Pohl et al. (2010) and Wittmayer & Schöpke (2014) describe as the reflective researcher. This role remains closest to classic research, and overlaps strongly with qualitative inquiry traditions of field immersion and rapport building (Lincoln & Guba, 1985). Furthermore, this phase provided the grounding, contextual understanding, and networks that made further engagement possible. The connections established during the internship—in municipal offices and among local researchers and practitioners—later enabled me to convene a diverse group of stakeholders for the Project-Based Research (PBR) forum (see next Section 6.3.2). Without these earlier relationships, it would not have been possible to secure participation from such a broad range of relevant actors or to create a credible platform for dialogue.

At the same time, the internship generated outputs that went beyond networking and data collection. Notably, the fieldwork in Goto City culminated in my lead authorship of an IGES booklet “Pathway to a Zero Carbon City: Island of Energy, Goto City”, which presented the

municipality's pioneering practices in renewable energy and novel multi-stakeholder collaborations (Myasoedov & Ota, 2021). This output translates empirical insights into a form that is both accessible and useful for policymakers and practitioners, while also reinforcing IGES's policy advisory mission.

Thus, the Musha-shugyo internship served as an important early phase, helping me refine the survey design and ensuring that my later analysis was grounded in field realities. More importantly, it prepared me to step into more participatory and catalytic roles in the subsequent participatory exercise – an international forum, where I acted not only as a reflective researcher presenting preliminary findings but also as a knowledge broker and process facilitator, enabling exchange, dialogue, and collective learning among stakeholders. The following section turns to this forum, which represents the second major component of my transdisciplinary activities.

6.3.2 Project-Based Research: International Forum on Zero-Carbon Cities

The International Forum on Zero Carbon Cities titled “Zero-Carbon Cities: Opportunities, Challenges, Solutions” was planned and organized by me and held in a hybrid format at Kyoto University in October 2022, shortly after I had completed the municipal survey (June–August 2022). Co-facilitated together with my academic supervisor, the forum was designed not as a one-way knowledge-dissemination exercise but as a platform for structured dialogue and knowledge exchange. Its timing was deliberate: I was able to present preliminary survey results while leaving room to integrate stakeholder reflections before finalizing my analysis and preparing publications.

The program was sequenced to move across different scales of perspective. It opened with a *global-to-national* perspective on the net-zero challenge by a professor from the University of Tokyo, who highlighted Japan's relatively low level of public exposure to climate information compared to other countries. Then, moving to the *collective municipal level*, I presented my initial findings from the survey of 309 net-zero-committed municipalities in Japan, outlining preliminary patterns of motivations and challenges. At the *individual city level*, officials from Kyoto and Kobe presented their cities' pathways and initiatives toward net zero and the challenges they face. Finally, an *international perspective* was offered by an academic and city planner from Curitiba, Brazil, reflecting on decarbonization and sustainability practices of this widely acclaimed sustainable city in Latin America.

These core presentations were followed by three expert commentaries, each adding a distinctive angle. A representative from ICLEI commented from the perspective of a *global city network*, situating the Japanese experience within wider international trends. A researcher from IGES Kitakyushu reflected on the *community level*, sharing lessons from organizing citizen engagement workshops in Kitakyushu. Finally, a professor from Bandar Lampung, Indonesia, contributed a

commentary from Southeast Asia, particularly from the perspectives of *governance* and *architecture* in a developing country setting.

Such diverse panelist composition was intentionally planned to cover perspectives from a wide range of geographical regions, institutional scales, and disciplinary fields. Following the framework of Pohl (2011), these perspectives can be understood as distinct ‘thought-styles’, a concept originating with science philosopher Ludwik Fleck and later influential in transdisciplinarity debates. Pohl conceives transdisciplinary research as “the interaction of academic and non-academic thought-styles” within a project, whereby disciplinary researchers, policymakers, practitioners, and civil society representatives collaborate to co-produce knowledge (Pohl, 2011). In this sense, the forum was designed as an arena in which multiple thought-styles could meet: international academia, municipal government, international city networks, community-level engagement, and the broader public (Figure 6.2).

Figure 6.2. Conceptual representation of the PBR forum

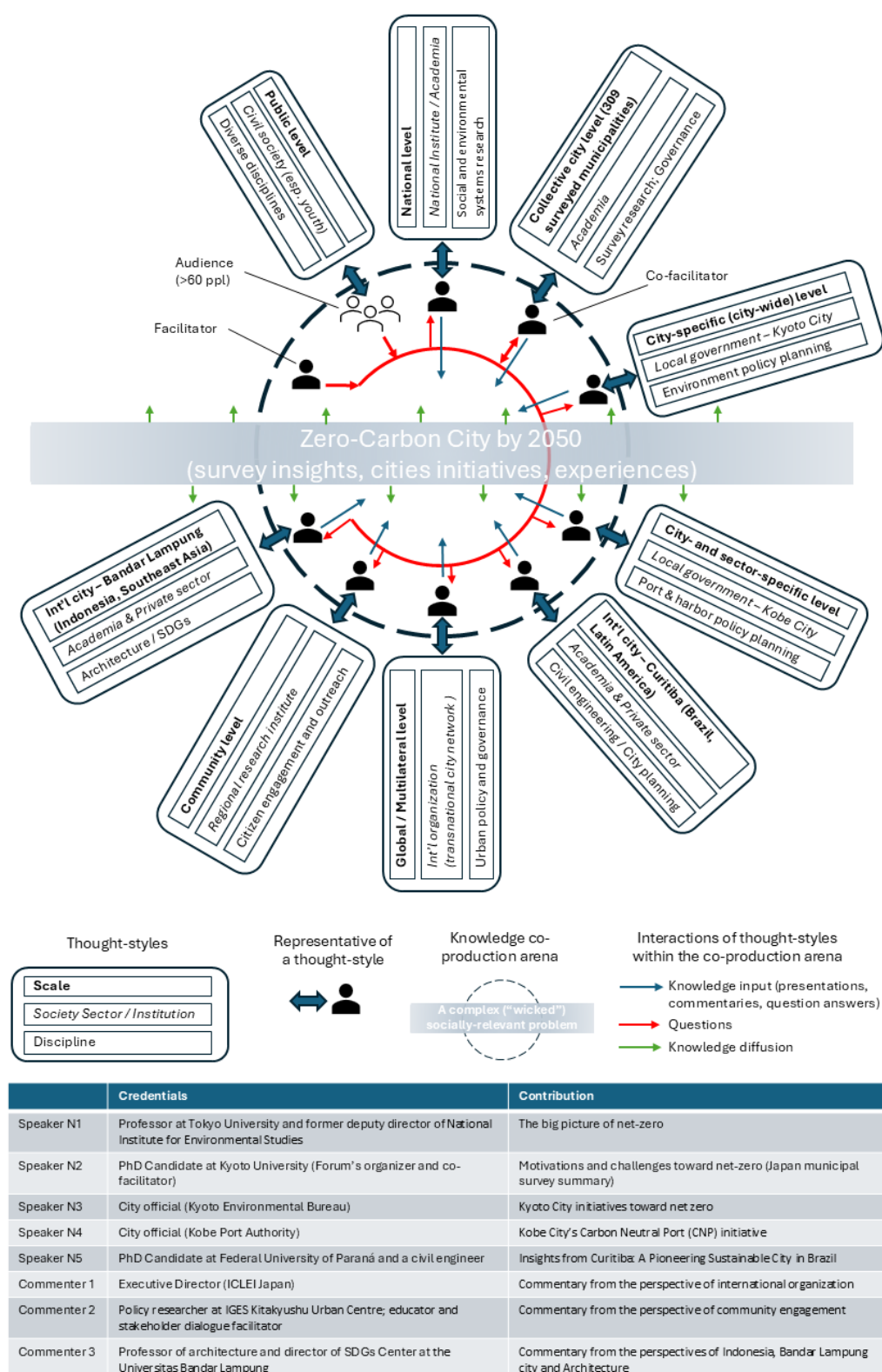


Figure 6.2 depicts the PBR forum as a temporary arena for integrating perspectives on the complex issue of achieving zero-carbon cities by 2050. Rectangles represent the thought-styles of forum participants,

encompassing diverse scales, sectors of society, and disciplines. Blue arrows indicate knowledge inputs from speakers (1–5), including the author’s presentation of preliminary survey findings, with commenters (1–3) providing feedback and reflections. Red arrows show questions posed by facilitators and the audience during interactive Q&A sessions. Green arrows represent knowledge co-produced and diffused among all participants. Source: Author’s adaptation from Pohl’s (2011). Note: For the detailed results of the forum, see Appendix D, Section 4.2.

From the perspective of Wittmayer & Schöpke’s (2014) sustainability researcher roles, during the internship and fieldwork, I had mainly acted as a reflective scientist, gathering and interpreting insights from municipal contexts. In the forum, I retained this role by presenting survey findings rigorously, but I also became a knowledge broker by making those findings accessible to a diverse audience, and a process facilitator by guiding the dialogue so that knowledge could circulate across scales and actor groups. What made the forum significant was not only that my research benefited from stakeholder feedback, but that it also created learning opportunities for all involved: municipal officials encountered new perspectives raised by the public, international experts added to and learned from the Japanese experience, and the audience benefited from knowledge, while also influencing the conversation through their questions.

Positioned after the internship, the forum demonstrates how I have attempted to build my transdisciplinary contribution step by step. The internship had provided immersion, contextual awareness, and the relationships necessary to plan and convene the forum. The forum itself then built on these early engagements, creating a structured setting where academic research and practitioner perspectives could interact. In summary, the PBR demonstrates how a doctoral project can transcend merely producing knowledge about municipalities to actively facilitating processes of dialogue and collective learning among different actor groups, thereby representing a transdisciplinary contribution.

6.3.3 Other Action-Oriented Contributions

In addition to the internship and the PBR forum, I engaged in several further activities that demonstrated elements of the change agent role within Wittmayer & Schöpke’s (2014) typology. These went beyond analysis and facilitation to include civic participation, activism-oriented engagement, and sustainability education and awareness-raising.

One such contribution was my participation in the public hearing on the release of the Kitakyushu City Global Warming Countermeasures Action Plan draft. In this hearing, I acted not only as an observer but also as a participant in the city’s public comment system by submitting feedback on the plan. As described in my Working Paper (Appendix D), this represented a modest but concrete form of civic engagement in policymaking. It illustrates how researchers can move beyond the role of detached analysts to contribute their informed perspectives within participatory governance processes—making their voice heard as engaged citizens rather than remaining in the position of a “passive scholar.”

I also contributed to sustainability education and awareness-raising activities, aimed mainly at (but not limited to) university students. For example, I organized a session of the internationally recognized “2030 SDGs Game” at Kyoto University, a simulation game designed to raise awareness of the Sustainable Development Goals and let participants experience their underlying principles (*2030 SDGs GAME*, 2018). While an accredited professional facilitated the event, I was responsible for all planning, organizational, and promotional aspects. By creating an opportunity for students and other attendees to confront sustainability dilemmas interactively, this activity aligned with the educational and activism-oriented functions of the change agent role, fostering awareness and stimulating youth engagement.

Finally, I leveraged professional connections established at an international policy conference in Toronto to organize a mini-workshop at Kyoto University in January 2024. The event, titled “Local Approaches to Sustainability Management: Youth, Partnerships, and Urban Sustainability”, featured a keynote address by an international scholar with expertise in urban sustainability governance and youth engagement. By inviting a global expert to share her research and facilitating direct dialogue with students, I aimed to address themes that have been raised by the audience during the PBR forum—specifically youth participation, climate education, and civic engagement (see Section 6.3.2). This event created a space where international expertise could be connected with Japanese (and foreign) students, deepening dialogue about the role of youth in sustainability transitions.

Overall, these action-oriented activities represent my efforts to act beyond conventional researcher roles and to contribute more directly to sustainability transitions through active engagement. The activities, such as submitting a public comment, organizing the SDGs Game, and convening an international workshop, highlight the potential for researchers to take on the role of change agents—shaping policy debates, empowering youth and citizens, and fostering international exchange on sustainability governance.

6.3.4 Summary of Participatory/Catalytic Research Activities

The activities described in this section exemplify my efforts to strengthen the participatory and catalytic dimensions of research. Rather than solely remaining a “detached analyst”, I sought to experiment with different modes of participation and engagement, corresponding to several of the researcher roles identified by Wittmayer & Schöpke (2014).

The Musha-shugyo internship and fieldwork formed the foundation, reflecting the role of the reflective researcher. Immersion in municipal contexts across Kyushu allowed me to build trust and contextual awareness, refine my survey design, and produce outputs such as the Goto City fact sheet that translated local insights into accessible policy-oriented knowledge. The PBR forum extended this engagement by combining the roles of knowledge broker and process facilitator. By

presenting preliminary survey findings and moderating dialogue among diverse stakeholders, I was able not only to test and refine my results but also to create a collective learning space. Such a collective learning space, following Pohl et al (2010) conceptualization, gathered representatives of diverse thought-styles and brought them into interaction, enabling cross-fertilization and the diffusion of knowledge across different thought-collectives.

Finally, the action-oriented contributions—such as submitting a public comment on Kitakyushu’s climate plan, organizing the “2030 SDGs Game,” and convening an international workshop on youth and sustainability—highlighted the change agent role. These activities illustrate how researchers can contribute more directly to civic debates, awareness-raising, and youth empowerment.

Table 6.4 summarizes these participatory activities, illustrating how they align with different sustainability researcher roles and their respective contributions.

Table 6.4. Overview of participatory activities and corresponding researcher roles

Activity	Description	Corresponding researcher role(s)	Main contributions
Musha-shugyo Internship (Apr–Nov 2021)	Immersion in municipal contexts across Kyushu (interviews, site visits, observations); building networks; producing Goto City fact sheet	Reflective scientist (field immersion, analytical rigor); Knowledge broker (Goto City booklet translating research for policy audiences)	Provided contextual grounding, strengthened credibility, refined survey design, and produced outputs useful for practice
PBR Forum: International Forum on Zero Carbon Cities (Oct. 2022)	Planned and organized multi-stakeholder forum; presented preliminary survey results; co-facilitated structured dialogue; ensured follow-up and knowledge circulation	Reflective scientist (presenting findings); Knowledge broker (making survey insights accessible to broad audiences); Process facilitator (structuring dialogue, enabling exchange)	Created a genuine knowledge co-production arena; tested findings with practitioners; enabled multi-directional learning across scales and stakeholders
Participation in Kitakyushu public hearing & public comment submission (Jun 2021)	Attended city hearing on climate action plan draft and submitted comments through official system	Change agent (citizen activism); Knowledge broker (sharing own research-informed opinion with the city government)	Direct civic engagement in policymaking; modest but concrete contribution to participatory governance
Organization of “2030 SDGs Game” (Oct. 2022)	Organized awareness-raising simulation game on SDGs (facilitated by accredited trainer)	Change agent (SDGs/climate activism); Process facilitator (creating space for societal learning)	Promoted public (mainly youth) awareness-raising and engagement with SDGs through interactive learning
Organization of international mini-workshop (Jan. 2024)	Invited international scholar on urban sustainability governance and youth engagement; organized workshop at Kyoto University	Knowledge broker (bridging international expertise and local audience); Change agent (creating space for youth-focused dialogue)	Responded to themes raised during PBR forum; facilitated exchange between global expert and Kyoto University students

Source: Author’s elaboration based on the researcher roles framework proposed by Wittmayer and Schöpke (2014) in process-oriented sustainability science.

6.4 Self-reflexive Discussion in Relation to the GSAIS Curriculum and a Framework Operationalizing Transdisciplinary Theory

6.4.1 *Trans-Science as a Parallel Route to Transdisciplinarity*

Chapter 6 has outlined how my doctoral research incorporated a range of activities undertaken in the spirit of transdisciplinarity, particularly those corresponding to Renn's (2021) *catalytic* modular transdisciplinary dimension. In this dimension, the researcher assumes the role of a catalyst (initiator) of the sustainable transition. Renn describes the catalytic approach as one that seeks to integrate non-scientific knowledge through "communicative design" and "deliberative discourse between various knowledge carriers" (Renn, 2021). This view closely parallels Pohl's (2011) conception of transdisciplinary research as a "collaboration of representatives of different thought-styles" (Pohl, 2011). Put differently, a defining feature of transdisciplinary inquiry is its commitment to *knowledge co-creation*—"a collaborative process that unfolds at the intersection of science and society" (Pohl et al., 2010, drawing on Robinson & Tansey, 2006).

Such an intersection, often described as a nexus space between science and society, has been conceptualized differently across scholarly traditions. In Western discourse, it is referred to as the *agora*, where "science meets the public and the public speaks back to science" (Pohl et al., 2010, drawing on Nowotny et al., 2001). In Japan, over the past decade a comparable notion has gained traction through the concept of the "republic of trans-science" (Yamaguchi, 2018). Building on Alwin Weinberg's insight, a Japanese scholar Eiichi Yamaguchi argues that many contemporary issues—such as climate change, energy transition, and public safety—occupy an in-between realm that lies beyond the reach of disciplinary science yet still demands evidence-based reasoning. This domain, situated between the "republic of science" and the "republic of politics," is one in which knowledge alone cannot determine the best course of action, making societal participation and ethical judgment indispensable (Weinberg, 1972; Yamaguchi, 2018, 2019).

The crises that shook Japan in the early twenty-first century—including the Fukushima nuclear disaster (2011), which, as Yamaguchi explains, resulted from delayed managerial decisions to flood the reactors with seawater during a critical period in the hope of saving expensive equipment—revealed how ill-equipped modern institutions are to respond to boundary problems that span science, technology, and governance. This and similar events, Yamaguchi argues, together with a growing range of complex global challenges, revealed the fragility of public trust in science and underscored the need for stronger *resonance* between scientific reasoning and societal values (Yamaguchi, 2018, 2019).

Yamaguchi conceptualizes this resonance through the interplay of two metaphors—"night science" and "day science." Night science refers to exploratory, curiosity-driven inquiry conducted in relative isolation from societal values; it represents the dark realm of tacit knowledge where

discoveries are made and new knowledge emerges. Although night science remains largely invisible to the public, it provides the foundation for innovation and evidence-based policy. Day science denotes the application and embodiment of that knowledge in social and technological contexts, where value judgments and political choices inevitably come into play. Modern education, Yamaguchi argues, must train individuals to travel between these two realms—to experience how new knowledge is made, while also understanding how knowledge acquires value and meaning in the daylight of society. In other words, achieving resonance between these realms requires a new educational paradigm that bridges the divides between disciplines, between science and non-science, and between scientific evidence and human judgment (Yamaguchi, 2018, 2019).

This dynamic of resonance reflects the same integrative ambition that underpins transdisciplinary research—to enable mutual learning and the co-creation of understanding among distinct thought-styles (Pohl, 2011). Similarly, it echoes Renn’s (2021) notion of the catalytic function of science, whereby researchers act as facilitators who connect analytical knowledge with societal deliberation and transformation (Renn, 2021). In this way, through the notion of “trans-science” and grounded in Japanese cases and experience, Yamaguchi arrives at similar conclusions to that of Western scholars advocating transdisciplinary research.

6.4.2 GSAIS: A Pedagogical Experiment in Trans-Science and Transdisciplinarity

These concepts, discussed by Yamaguchi and other like-minded Japanese academic and business leaders, have not remained theoretical and shaped educational innovations in Japan, culminating in the establishment of Kyoto University’s Graduate School of Advanced Integrated Studies in Human Survivability (GSAIS). Founded in 2013 as a new and independent graduate school, rather than an auxiliary program within existing faculties, GSAIS was conceived as an institutional experiment to embody and operationalize many of the ideas outlined above.

The GSAIS curriculum translates these philosophical principles into a concrete educational framework. Its program structure is built around two core components: *Musha-shugyo*, a long-term internship or field placement in an external organization that immerses students in real-world contexts relevant to their research; and *Project-Based Research (PBR)*, a self-directed research project designed and implemented in collaboration with societal actors. Together, these components institutionalize learning through engagement, enabling students to experience the interface between scientific reasoning and societal practice. They reflect Yamaguchi’s call for resonance between night science and day science while aligning closely with notions of transdisciplinarity as a dialogue between academic and non-academic knowledge communities (Pohl et al., 2010; Yamaguchi, 2018). The program is also grounded in the Buddhist triad of *Mon-Shi-Shu* (*hearing–thinking–practicing*), which frames learning as a continuous cycle of understanding, reflection, and embodied application (Deroche, 2021; Kawai & Oshima, 2018).

A further distinctive feature of GSAIS is that it establishes and advances Human Survivability Studies (HSS) as a new integrative academic field. HSS aims to address global, systemic challenges that threaten the long-term survival and flourishing of humanity—such as climate change, resource depletion, pandemics, and social instability. It is explicitly problem-driven and goal-oriented, combining insights from the natural, social, and human sciences to develop actionable knowledge for the common good. By adopting a comprehensive “bird’s-eye” view that integrates disciplinary perspectives with a “worm’s-eye” engagement in local contexts, HSS seeks both to generate theoretical understanding and to promote practical solutions (Kawai & Oshima, 2018). In doing so, it embodies the four defining features of transdisciplinarity identified by Pohl (2011): engagement with socially relevant issues, integration across disciplinary paradigms, participation of societal actors, and the pursuit of a unity of knowledge through reflective synthesis.

Thus, GSAIS represents an institutionalized effort to realize ideas of trans-science and transdisciplinarity, creating a structured educational environment where students learn to cross boundaries between science and society. The Musha-shugyo internship, the PBR forum, and the related action-oriented activities discussed in this chapter are direct expressions of this educational philosophy.

6.4.3 A Framework for Operationalizing Transdisciplinary Learning

Drawing together these theoretical perspectives and institutional foundations, I developed a framework for operationalizing transdisciplinary theory within graduate-level sustainability and human-survivability research (Figure 6.3). The framework integrates Western transdisciplinary traditions (Pohl, 2011; Pohl et al., 2010; Renn, 2021; Wittmayer & Schäpke, 2014) with Eastern philosophical thought (Deroche, 2021; Kawai & Oshima, 2018; Yamaguchi, 2018, 2019) into a coherent and practical model. It serves as an operable blueprint—a researcher-oriented heuristic that translates abstract theoretical constructs into concrete strategies for designing and conducting transdisciplinary inquiry.

Figure 6.3. An integrative conceptual map operationalizing transdisciplinary theory into a researcher-oriented heuristic (based on the author’s experience and self-reflexive contemplation)

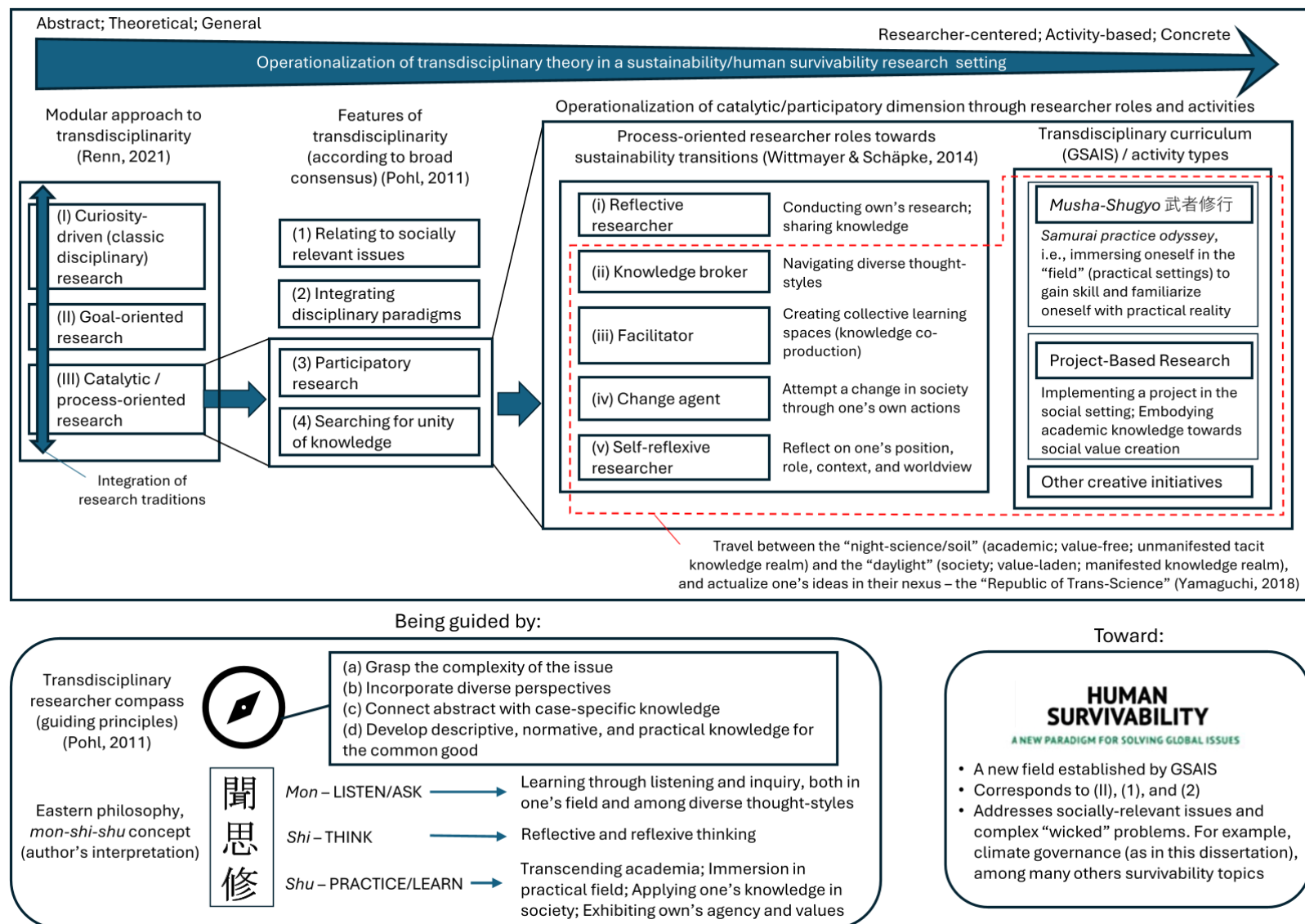


Figure 6.3 exhibits a framework that integrates Western transdisciplinary theorizing with Eastern philosophical traditions into a coherent, practice-oriented model. It serves as a heuristic tool to help researchers orient themselves within abstract theoretical frameworks and to plan their own interventions and learning trajectories toward a transdisciplinary contribution. Source: author's integrative conceptualization based on existing theories.

The framework illustrates a progressive flow from theory to practice. It links the abstract foundations of transdisciplinary research—such as Renn's (2021) modular model and Pohl's (2011) defining features—to the researcher roles proposed by Wittmayer and Schöpke (2014), which operationalize the catalytic and participatory dimensions of transdisciplinarity. It then demonstrates how these roles can be enacted within graduate programs, using the example of GSAIS, where Musha-shugyo and Project-Based Research (PBR) represent institutionalized efforts that enable students to translate these principles into action. These learning settings provide students with opportunities to engage with diverse actors and experiment with different researcher roles.

The framework also bridges the “trans-science” conceptualization by Yamaguchi (2018, 2019): catalytic activities enable researchers to move beyond the academic “night-science” realm of abstract, value-neutral knowledge into the “daylight” of society, where ideas can be tested, embodied, and transformed into social value. Researcher-led collaborations with societal actors and direct participation in real-world initiatives are efforts that bridge academic and non-academic domains, strengthen public trust in science, and respond to the “trans-science” challenges that disciplinary expertise alone cannot resolve.

The framework also incorporates a normative compass to guide researchers on their path toward transdisciplinary practice. It brings together two complementary modes of orientation. The first is the explicit set of guiding principles derived from transdisciplinary theory, which help researchers reflect on their current position and direction (Pohl's transdisciplinary “purposes”). The second is the Eastern philosophy of Mon-Shi-Shu (listening-thinking-practicing), which offers a more intuitive and flexible form of guidance. Unlike explicitly verbalized rubrics, Mon-Shi-Shu allows individuals to interpret and apply its meaning in ways that suit their own learning process, encouraging movement from receiving knowledge, to generating it, and ultimately to embodying it in practice. Together, these two modes provide both structure and creative freedom—helping researchers navigate their personal and collective journeys toward transdisciplinary understanding and action.

Finally, the framework positions human survivability as the overarching goal of transdisciplinary inquiry. In doing so, it directs curiosity-driven research toward socially relevant and goal-oriented pursuits. Human Survivability Studies provides a broad interdisciplinary field that encompasses complex societal challenges extending beyond conventional sustainability concerns.

While sustainability may not directly align with every research focus, the concept of human survivability offers a broader context relevant to most researchers, inviting reflection on humanity's collective future. It also embodies the essence of transdisciplinary research—addressing “wicked” and complex problems that cannot be solved through disciplinary methods alone, and thus encouraging researchers to integrate diverse forms of knowledge, cross disciplinary boundaries, and engage actively with societal actors.

Overall, the framework presents a flexible model for cultivating participatory and catalytic competencies, enabling students to experiment with different roles as they move through various phases of research and levels of engagement with society. Its purpose is to make transdisciplinary practice more accessible and realistic—less abstract and idealized—by offering researchers an actionable pathway for integrating transdisciplinary dimensions into their work. The framework is particularly useful for students in sustainability-oriented programs, providing a practical heuristic for introducing transdisciplinary elements without the need to completely overhaul their research design or depart from their disciplinary expertise. It encourages students to plan and test diverse activities and assume different researcher roles, allowing them to engage with transdisciplinary theory in a realistic, adaptable, and experience-based manner.

6.5 Conclusion

This chapter has explored the catalytic/participatory dimensions of my doctoral research, demonstrating how transdisciplinary principles can be practiced within a graduate school environment. Through activities such as Musha-shugyo (internship/fieldwork) and the PBR (multi-stakeholder forum organization), as well as other action-oriented engagements, I examined how research can move beyond individual scholarly analysis toward immersion in diverse thought-collectives, integration of perspectives, co-creation of knowledge, and attempts at societal change. These experiences were situated within the experimental educational setting of GSAIS, which represents an effort to institutionalize the ideas of transdisciplinarity, trans-science, and human survivability into doctoral education.

The framework developed in this chapter synthesizes these theoretical and institutional insights into a practical model for operationalizing transdisciplinary learning (see Figure 6.3). It offers a role-based and reflexive approach that helps researchers orient themselves within abstract theoretical frameworks and plan their own interventions and learning trajectories toward transdisciplinary contribution—by experimenting with various activities and researcher roles while maintaining their core disciplinary expertise.

The framework emerged through theoretical integration and self-reflective contemplation of my own experience and positionality within the GSAIS context. Observing how students, including myself, often struggled to conceptualize and plan transdisciplinary activities based on

abstract theories and in the absence of clear guidelines and consensus, I was inspired to develop a framework that renders transdisciplinary practice more tangible and accessible. In undertaking this integrative and reflexive process, I also assumed the self-reflexive researcher role, thereby completing the spectrum of process-oriented researcher roles identified by Wittmayer and Schöpke (see Figure 6.1 for the full overview of activities and assumed roles).

Despite these contributions, it is important to acknowledge several limitations. The activities and researcher roles described here were undertaken primarily within the framework of an experimental graduate curriculum rather than through a purpose-built transdisciplinary project. Consequently, they may be seen as only partial efforts compared to more rigorous and “pure” transdisciplinary research designs. Furthermore, the time, resource, and other constraints inherent to doctoral study limited the extent of collaboration and continuity that could be achieved. Yet these boundaries also define the reality of early-career research and highlight the value of learning through incremental, exploratory practice. The experiences presented here should therefore be understood as experimental and illustrative steps—small but deliberate attempts to enact transdisciplinary principles in a graduate education context and to explore what such engagement might look like in practice.

In conclusion, this chapter has bridged theory and practice, reflecting the experience of a graduate student working within an experimental institutional setting. It is my hope that these reflections, together with the theoretical and practical contributions presented here, will stimulate further discussion on research practice, curriculum design, and the evolving role of academia in transcending disciplinary boundaries towards sustainability transitions and human survivability.

Chapter 7. Final Reflections, Holistic Model Synthesis, and Concluding Remarks

7.1 Introduction

The dissertation has presented a series of contributions to the literature on local climate governance regarding what motivates municipalities to pursue net zero emissions and the barriers and enablers influencing their progress. Chapter 2 introduced an Integrated Framework of the most common Motivations, Barriers, and Enablers (MBEs) synthesized from the existing literature (Tables 2.1, 2.2, 2.3, and Figure 2.1).

The survey instrument described in Chapter 3 was designed based on this framework and administered to a large sample of 489 Japanese municipalities that had formally committed to net-zero targets. The survey aimed to capture multiple layers of information—ranging from (1) quantitative evaluations of MBE items on a five-point Likert scale, to (2) the single-item prioritizations of the most important factors, and (3) qualitative free-text elaborations explaining respondents' reasoning and exposing the surrounding context of their responses.

Chapter 4 presented the results of the quantitative analysis: descriptive statistics from the survey's numerical data, showing which MBE factors were seen as most important among Japan's Zero-Carbon Cities. It also featured a correlation analysis (Spearman's Rho) to uncover potential interrelations among factors based on their co-occurrence in municipal evaluations.

To move beyond mere ranking of factors, Chapter 5 complemented the quantitative findings through thematic analysis of the textual data. Common patterns in municipalities' written explanations were synthesized into themes (Tables 5.3–5.5), which reveal how officials rationalize and contextualize their most significant MBEs. These themes illuminate the underlying reasons why particular factors are viewed as especially critical, providing richer insight into municipal perspectives on the motivations, enablers, and constraints shaping local climate action. Together, the quantitative rankings (Chapter 4) and qualitative themes (Chapter 5) present a comprehensive picture of the MBEs most salient to Japan's net-zero municipalities.

Chapter 6 then extended the study beyond disciplinary boundaries by engaging in transdisciplinary activities that integrated participatory research components (Figure 6.1). These activities not only enhanced the preparation and triangulation of the empirical work—for example, the Musha-shugyō internship and fieldwork conducted prior to the survey (see Chapter 6.3.1 and Appendix D)—but also facilitated interaction with diverse societal actors through initiatives such as the Project-Based Research (PBR) Forum (Chapter 6.3.2). Furthermore, these engagements enabled the researcher to contribute directly to societal learning and practice, exemplifying the action-oriented and catalytic dimension of transdisciplinary research (Chapter 6.3.3).

Building on all these strands, Chapter 7 performs the final synthesis of the study's multiple outcomes, consolidating them into a holistic framework of motivations, barriers, and enablers that represent the ultimate contribution of this dissertation. It also offers a set of recommendations derived from the integrated findings, aimed at policymakers (across national, prefectural, and municipal levels), academics, research institutions, and a broader audience concerned with local governance and climate action. The chapter begins by discussing the overall survey results in relation to existing literature, and then proceeds to the final synthesis, recommendations, and concluding reflections.

7.1.1 Discussion of the Study Outcomes in Relation to Existing Literature

7.1.1.1 Conceptual and Empirical Traditions in Local Climate Governance Research

Existing studies on local climate governance, especially those that examine multiple MBEs (i.e., studies that examine more than a few specific factors), can be broadly divided into two categories: conceptual literature reviews and empirical survey-based research. Conceptual studies review MBE factors based on prior research (e.g., Bulkeley et al., 2009; Romero-Lankao et al., 2018; Sippel & Jenssen, 2009; van der Heijden, 2019) and some studies theorize about their classifications and interconnections (e.g., D. Ryan, 2015), while empirical studies use survey-based designs to capture practitioners' perspectives. Among the latter strand, some studies employ surveys as their primary methodological tool for collecting and analyzing original data (e.g., Aylett, 2014; Rhodes et al., 2021; Salon et al., 2014), whereas others use them complementarily to examine how municipal characteristics (e.g., population size, income level) as independent variables influence specific governance outcomes such as the adoption of climate goals or the development of action plans (e.g., Krause, 2013; Nakazawa et al., 2023).

Within the conceptual strand, several works have provided broad overviews of common factors influencing local climate action. Sippel and Jenssen (2009) summarized the key motivations and challenges of cities pursuing climate policies, while Bulkeley et al. (2009) identified both drivers and barriers shaping municipal engagement. Later, Romero-Lankao et al. (2018) and van der Heijden (2019) offered high-level syntheses emphasizing enabling conditions. Although these reviews effectively mapped the "universe" of frequently cited factors, they stopped short of integrating them into cohesive analytical frameworks or assessing their interrelations and relative importance.

A notable contribution came from Ryan (2015), who went beyond cataloguing factors and attempted to conceptually connect "local governance capacity" (largely corresponding to barriers and enablers) with "agency-related" dimensions that shape municipal actors' interests and preferences (i.e., political factors and motivations). He proposed that the key factors influencing local climate governance fall into three major categories: (1) "local governance capacity", which is a

necessary condition, but not sufficient, and must be complemented by (2) “political actors and factors” (e.g., policy entrepreneurs); and (3) “local framing” which Ryan posits as a crucial aspect lending social and political support towards city’s climate goals (D. Ryan, 2015). Although trail-blazing, Ryan’s analytical framework remained largely theoretical (based on a literature review rather than empirical evidence) and was framed primarily as a call for future research in this direction.

Building on these earlier conceptual foundations, the present dissertation developed a comprehensive, integrated framework of municipal MBEs of local climate governance (see Chapter 2), which served as the conceptual basis for the subsequent empirical investigation (Chapters 4–5). Drawing on 67 relevant literature sources, this framework consolidated and organized the extensive and overlapping factors identified in prior research into a structured and accessible system: nine major motivations across six categories; and key barriers and enablers grouped into four broader dimensions: (I) municipal capacity in terms of resources and authority; (II) municipal capacity in terms of climate knowledge and expertise; (III) organizational coherence and cooperation; and (IV) political will and leadership (see Tables 2.1–2.3). Following hints from various literature regarding the interrelated nature of local governance factors (e.g., Burch, 2009; Burch, 2010b; Eisenack et al., 2014; D. Ryan, 2015), all identified MBEs were placed together on a single conceptual diagram to indicate that factors are interwoven and influence each other (see Figure 2.1). The framework therefore constitutes an organization/systematization contribution (by distilling and cataloguing of the factors) and a conceptual novelty (by depicting the three main concepts—motivations, barriers, and enablers—in relation to each other).

7.1.1.2 Large-N Survey Research and the Positioning of the Present Study

Following the conceptual literature, only a limited number of empirical studies have explored local climate governance through large-scale surveys comparable in scope to the present research. The majority of empirical works in this domain have been case-based, often focusing on one or a few municipalities, while only a handful of studies have attempted to capture broader practitioner perspectives using survey instruments. These include Aylett’s (2014) Global Survey of Urban Climate Governance covering 350 ICLEI member cities worldwide, Salon et al.’s (2014) survey of all cities and counties in California, Krause’s (2013) U.S. municipal survey, and Rhodes et al.’s (2021) regional survey of local governments in British Columbia.

All of these studies, though differing in scope and detail, addressed multiple dimensions of local climate governance, including at least one of the three MBE components—motivations, barriers, or enablers—examined in this dissertation. Krause (2013) focused solely on the motivational aspect of municipal climate action and, in addition to survey data collection, analyzed how motivations affected the comprehensiveness of city climate policies through regression analysis. The

other studies were broader in scope but more descriptive and exploratory in nature, addressing multiple MBE aspects to varying degrees and involving more extensive engagement with respondents cities. Aylett's (2014) survey was the most comprehensive in design (69 questions) but was not triangulated with qualitative data. Rhodes et al.'s (2021) questionnaire included both closed-ended and open-ended questions; however, the closed-ended items were multiple-choice rather than evaluative, which only allows for analysis of frequency counts rather than importance ratings. Salon et al.'s (2014) survey contained only closed-ended evaluative questions, but the selection of items—covering motivations, barriers, and enablers—was relatively limited. In addition, they complemented the survey with eight case studies (several interviews in each of the eight cities).

These studies are therefore closely related to the present research, yet they differ substantially in methodological design, depth, and analytical scope. Table 7.1 summarizes these studies in comparison with the present survey, outlining both methodological and substantive similarities and differences, as well as areas of convergence and divergence in their results.

In addition to these differences in scope and design, the present study advances methodologically by combining multi-layered quantitative and qualitative approaches within a single large-N framework. Whereas prior surveys relied primarily on descriptive statistics or frequency counts, this research integrated (1) five-point evaluative ratings of each factor, (2) forced prioritization of the single most important factor within each category, and (3) open-ended qualitative elaborations. This design enabled both quantitative ranking and interpretive depth, illuminating the contextual reasoning behind municipal choices. Moreover, the entire instrument was explicitly structured around the integrated MBE framework developed in Chapter 2, ensuring strong conceptual grounding—an element largely absent from previous large-scale survey research in this field.

7.1.1.3 Convergence and Divergence of Empirical Findings

A broad convergence emerges across these studies in identifying resource constraints as the most pervasive barrier to local climate action. Aylett (2014) found that lack of funding and limited staff capacity were the top challenges for the vast majority of surveyed cities, while Salon et al. (2014) similarly highlighted insufficient budgets and staff time as major obstacles in California. Rhodes et al. (2021) reported almost identical findings among Canadian municipalities, noting financial shortages, inadequate staffing, and limited institutional authority as primary impediments. The present survey of Japan's Zero-Carbon Cities echoes these global trends: municipal budgets, staff capacity, and organizational fragmentation consistently emerged as the most critical barriers to progress toward net zero.

Table 7.1. Comparison of Large-Scale Survey Studies on Local Climate Governance

Study	Geographic scope / Sample	Main objective	Key motivations	Key barriers	Key enablers	Methodological notes
Aylett (2014)	Global: 350 (264 full responses) across ICLEI member cities	Assess progress, challenges, and enablers of urban climate governance	Political leadership; Sustainable development; Quality of life	Lack of funding; Limited staff capacity; Competing priorities	Leadership from mayors and senior managers; Inter-municipal networks; Funding availability	Questionnaire survey (closed-ended) (69 questions, 1–4 scale). Descriptive analysis.
Salon et al. (2014)	United States: 159 cities & 28 counties in California	Identify motives, enablers, and barriers to local climate action	Local co-benefits; Cost savings; Environmental stewardship	Limited funding and staff time	Not systematically evaluated; inferred from obstacles	Questionnaire survey (closed-ended) + case studies. Descriptive analysis.
Krause (2013)	United States: 245 U.S. cities in 42 states; only cities with > 50,000 population	Examine how motivations shape climate policy engagement	Energy and cost savings; Political entrepreneurship; Global contribution	—	—	Questionnaire survey (closed-ended). Data used as input for regression analysis.
Rhodes et al. (2021)	Canada: 38 municipalities and 10 regional districts in VICC region of British Columbia	Identify climate priorities, barriers, and opportunities	Public/political demand; Concern for local impacts; Future preparedness	Insufficient financial and human resources; Limited authority	Not explicitly evaluated (discussed “opportunities”)	Questionnaire survey; mixed closed/open questions. Descriptive analysis
Present Study	Japan: 489 (309 responses) net-zero-committed “Zero-Carbon City” municipalities (all sizes, nationwide)	Identify and prioritize key motivations, barriers, and enablers in municipal net-zero governance; Gain contextual insight, including factor interrelations; Synthesize analytical frameworks	Local economic development (local energy development, financial benefits, community revitalization); Residents’ safety; Quality of life	Limited budgets; Insufficient staff; Limited expertise; Weak inter-departmental coordination; Low climate awareness in the city hall and among residents	Adequate financial & human resources and expertise; Strong inter-departmental coordination; Stakeholder cooperation; Leadership by climate champions;	(1) Questionnaire survey: 5-point evaluation (50 question-items) + single-factor prioritization (9 questions) + open-text (9 questions). Quantitative (descriptive statistics; correlations) and qualitative (thematic) analyses. (2) Transdisciplinary activities; (3) Framework development

Source: Compiled by the author based on the review of existing survey studies relevant to the topic.

Regarding motivations, the results of this dissertation align closely with those of Krause (2013) and Salon et al. (2014), both of whom found that energy and cost savings were the strongest drivers of local climate engagement. In Krause's national U.S. survey, "achieving energy and cost savings for city governments" ranked far above altruistic or global concerns, while Salon et al. (2014) similarly identified "tangible local co-benefits"—financial savings, improved environmental quality, and community attractiveness—as leading motives. The present study revealed a comparable pattern, though in a more differentiated form: the three top motivations—enhancing local energy conditions, generating financial gains and savings, and revitalizing local industry—collectively constitute the broader category of local economic development. This cross-study alignment reinforces the notion that economic co-benefits remain the most universal and durable rationale for local climate action across governance contexts.

However, notable differences appear in the relative prominence of political or symbolic motivations. Aylett's (2014) global study, which drew exclusively from ICLEI member cities, found that "demonstrating leadership" and "gaining political visibility" were among the most frequently cited drivers. This emphasis is understandable, given that ICLEI membership itself reflects a proactive and outward-oriented stance, where municipal participation often serves as both a commitment and a form of political signaling. Similarly, Rhodes et al. (2021) reported "public and political demand" among the five most common motivational themes for Canadian municipalities. By contrast, the Japanese municipalities in this survey ranked such outward-facing motivations—green branding, global contribution, and political leadership visibility—lowest, emphasizing instead internal and pragmatic goals such as local economic vitality, community safety, and residents' quality of life. This distinction points to a more pragmatic and internally oriented mode of municipal climate governance in Japan, as compared to the advocacy-oriented posture observed among Canadian municipalities and the networks of global frontrunners. (i.e., ICLEI).

With respect to enablers, the convergence is again strong, though the comparative emphasis differs. In Aylett's (2014) global analysis, "leadership from mayors and senior management" clearly topped the list of enablers, followed by "support from inter-municipal networks" and "funding from higher levels of government". In contrast, in the present survey—where enablers were evaluated separately across four categories—factors related to Municipal Capacity (adequate budgets and sufficient staff) received the highest overall mean scores among all enablers, surpassing those in other categories. Nevertheless, within the Political Will and Leadership category, climate champions (i.e., mayors or senior officials promoting net-zero agendas) were recognized as the top enabling factor. Thus, while Aylett's ICLEI sample underscored the centrality of leadership, the Japanese results suggest that institutional and resource adequacy plays an even more decisive enabling role, with leadership effectiveness contingent on the availability of such capacity.

7.1.1.4 Japanese Contextual Specificities

While many of the motivations, barriers, and enablers identified in this study align with international survey findings (see Table 7.1), the Japanese case reveals several contextual specificities that nuance the broader literature.

(1) Motivations: Climate Action as Local Survival Strategy

In contrast to survey studies of ICLEI-affiliated or North American cities, where political leadership and global signaling often rank highly (Aylett, 2014; Rhodes et al., 2021), Japanese municipalities overwhelmingly prioritize inward-oriented motivations (Section 4.2.1; Figure 4.1). Economic revitalization (M1.2), local energy autonomy (M1.3), and financial savings (M1.1) dominate the rankings, while “global contribution” (M6) consistently ranks lowest.

Qualitative themes (MT-5–MT-12; Table 5.3) demonstrate that climate action is frequently framed not as international leadership but as a strategy to address regional economic stagnation, depopulation and population aging, fiscal stress, and vulnerability to natural disasters. In this sense, net-zero is interpreted less as environmental advocacy and more as a pragmatic instrument for local socio-economic survival. This framing appears particularly salient in non-metropolitan municipalities, where demographic decline and industrial hollowing-out constitute structurally pressing concerns.

(2) Barriers: Capacity Constraints Under Demographic and Fiscal Pressure

While resource shortages are common in international studies, the Japanese findings suggest a structurally intensified form of municipal capacity constraint (Section 4.2.2; Figure 4.2). Budget limitations (B1.4) and lack of climate-dedicated staff (B1.7) rank as the most severe barriers. However, qualitative responses (BT-1–BT-3; Table 5.4) indicate that these constraints are embedded in broader local fiscal austerity, a shrinking and overstretched administrative staff, depopulation, and a heavy reliance on national budget transfers and subsidy schemes.

Unlike in federal systems, where cities may possess broader fiscal autonomy, Japanese municipalities operate within a highly centralized unitary framework. Although net-zero declarations are voluntary, implementation remains strongly dependent on vertical alignment and financial transfers (see BT-10, BT-13; Section 5.4.3.3). This creates a structural paradox in which bottom-up commitments coexist with constrained local implementation capacity.

(3) Institutional Culture: “Tatewari Gyōsei” and Internal Fragmentation

A further contextual specificity lies in the prominence of internal administrative fragmentation. While cross-departmental coordination is recognized as important globally, Japanese responses frequently invoke the concept of *tatewari gyōsei*—vertically segmented administration—as a persistent obstacle (BT-8; Section 5.4.3.3).

Inter-departmental coordination (B3.2) ranks among the most salient barriers (Section 4.2.2.3), while effective cross-sector coordination (E3.2) ranks among the strongest enablers (Section 4.2.3.3). The salience of this mirror relationship is reinforced by correlation analysis (Section 4.2.4), suggesting that organizational coherence constitutes a structural bottleneck. This does not imply that administrative silos are unique to Japan; however, their institutionalization and repeated emphasis by respondents indicate that they are experienced as particularly entrenched.

(4) Disaster Experience and Safety Framing

While resilience and safety motivations appear in international studies, in Japan they are deeply intertwined with lived disaster experience (MT-22–MT-24; Section 5.4.2.1). Municipalities frequently connect net-zero objectives to flood control, typhoon damage mitigation, heat stress management, and energy security during blackouts. Given Japan’s exposure to earthquakes, typhoons, and extreme rainfall, mitigation is often interpreted through a disaster-preparedness lens. This reinforces the integration of adaptation and mitigation logics within local reasoning.

(5) Leadership: Strong Enabler, Moderate Barrier

Another distinctive pattern concerns political will. Unlike some Western surveys where lack of leadership is framed as a dominant barrier, in this study the absence of champions does not rank among the most severe obstacles (Section 4.2.2.4). However, the presence of climate champions (E4.1) emerges as one of the strongest enabling factors (Section 4.2.3.4).

Qualitative themes (ET-16–ET-18) indicate that Japanese municipalities view leadership less as ideological entrepreneurship and more as a coordination mechanism, a lever for resource allocation, and a means of overcoming bureaucratic inertia. Leadership thus functions primarily as an internal governance instrument that mobilizes whole-of-government alignment.

The Japanese case highlights how shared governance dimensions can assume distinct practical meaning under different contextual conditions. These comparative insights point beyond individual factors toward their interaction. The next section considers why the literature increasingly calls for such a systemic view.

7.1.2 The Need for an Integrated and Systemic Understanding of Barriers, Enablers, and Motivations

Across the literature on local climate governance, researchers have identified numerous factors that influence municipal progress on climate action. Yet despite this abundance of insights, the field remains fragmented, and the interactions among barriers, enablers, and motivations are still poorly understood. Steg et al. (2022) note that although many studies have catalogued these factors, “a systematic and integrated assessment” of how they operate together is lacking. Strengthening one enabler or removing one barrier, they argue, can have “limited or even no effects” if other key obstacles remain. What is needed instead is a comprehensive perspective that exposes

these interconnections and identifies where policy interventions can have the most leverage (Steg et al., 2022).

This view is echoed across both the adaptation and urban governance literatures. Biesbroek et al. (2013) observed that interventions are often designed as simple countermeasures to individual problems—for example, prescribing additional funding whenever a lack of finance is identified—without addressing the deeper institutional or behavioral constraints (Biesbroek et al., 2013). Similarly, Burch (2010) found that barriers are “deeply interwoven phenomena” that reinforce one another and create inertia within the local governance system. Her study called for analytical approaches that can capture such dynamic interrelations, recognize the dual nature of many factors (which can act as either barriers or enablers), and explain how capacity is translated into action (Burch, 2010b). Moser et al. (2019) reached comparable conclusions in their analysis of adaptation finance, showing that “simply providing more funding” to local governments is insufficient when administrative capacity to apply for or manage funds is weak. Their work underscored that progress depends on “sustained partnerships and coordination” across levels of government and other actors (Moser et al., 2019).

These arguments have been reinforced by studies taking a broader systems perspective. Eisenack et al. (2014) urged scholars to move “beyond describing and enumerating barriers toward explaining them,” through approaches that uncover causal linkages and visualize dynamic interdependencies (Eisenack et al., 2014). The IPCC’s Sixth Assessment Report similarly concludes that transitions to low-carbon and resilient futures “rarely depend on any single factor,” but instead unfold through multi-level and multi-actor governance, where national, regional, and local governments collaborate with civil society and private stakeholders (Lwasa et al., 2022). Together, these studies suggest that barriers and enablers cannot be meaningfully addressed in isolation, since they are embedded in wider institutional, political, and social systems that both constrain and enable local action.

Along the same lines, some authors have highlighted the limits of focusing solely on municipal capacity issues. Ryan (2015) notes that while such capacity is a necessary condition for implementing climate policy, it cannot explain why cities choose to act. Ultimately, what drives implementation is agency—the motivations, interests, and preferences of those involved. Ryan also stresses that climate initiatives are more likely to gain traction when they are framed in relation to local concerns, such as employment, safety, or quality of life (D. Ryan, 2015). This kind of local framing helps to transform abstract global goals into visible local benefits, thereby sustaining both political and public support.

Overall, these literature insights reveal a common message: barriers, enablers, and motivations are interdependent, multi-level, and dynamic, yet the field still lacks an integrative framework that captures these relationships in a coherent way. Existing studies either list factors in

isolation or examine their interplay within narrow case studies. What remains missing is a structured perspective that explains how barriers and enablers reinforce or offset one another across governance levels and actor groups, and how motivations help bridge the gap between available capacity and actual action.

While the Integrated Analytical Framework introduced in Chapter 2 provided a structured synthesis and classification of motivations, barriers, and enablers, its role was primarily organizational—distilling fragmented knowledge into coherent categories and providing the backbone for the empirical survey. The literature reviewed above, however, repeatedly suggests that such factors cannot be fully understood as independent items, since they interact, reinforce, and condition one another across governance levels and actor groups. This implies a need to move beyond a classificatory inventory toward a more explicitly relational and systemic perspective.

The following sections respond to this need by outlining an integrative synthesis that brings the dissertation’s empirical findings and the above theoretical insights into a single systemic representation. The next section (7.2) therefore explains the methodological logic through which the model was developed, before the subsequent sections present its final structure and illustrate its implications.

7.2 Methodology: Making of an Integrated Heuristic Model of Local Climate Governance

Building on the conceptual foundations established in Chapter 2, combined with empirical insights from the survey (Chapters 4-6), this study culminates in the development of the Integrated Heuristic Model of Local Climate Governance (IHMLCG, or “IHM” for short). Whereas the earlier Integrated Analytical Framework (see Chapter 2) provided a structured synthesis of motivations, barriers, and enablers identified in the literature, the IHM moves beyond classification toward explanation. The term *heuristic* reflects the model’s dual purpose: it serves both as a conceptual lens for understanding the dynamic interplay of conditions shaping local climate action and as a diagnostic tool for reasoning about where and how interventions may most effectively enhance municipal progress toward net-zero transitions.

The making of the heuristic model was a gradual and reflective process aimed at synthesizing and visualizing the complex relationships among the key motivations, barriers, and enablers identified in this study. The synthesis resembled the thematic analysis in its inductive essence of moving from lower evidence-based insights to higher abstraction conceptual levels. However, rather than following any formal methodology, the model was a result of a mix of steps, methods, and insights from this doctoral study, combined in a final synthesis. It thus builds on multiple sources of insight: the thematic analysis of qualitative survey responses (Chapter 5), the statistical and correlation analysis (Chapter 4), the fieldwork and participatory activities described earlier

(Chapter 6), the theoretical guidance from the literature reviewed earlier, and my own accumulated experiential understanding of local climate policy processes.

7.2.1 *Synthesizing Motivations*

The synthesis began with the Motivations dimension. I first placed all individual motivation themes (MT-1–MT-26) identified through thematic analysis on a large blank digital canvas (A3 format), each written in its own rectangle. This visual exercise allowed me to see the full diversity of perspectives expressed by municipal officials. From there, much like the axial coding from the thematic analysis (see Section 5.2.2), I began intuitively grouping themes that shared a common meaning or were connected through a shared concern or underlying logic. Thus, original, specific themes were grouped within broader rectangles representing more conceptual higher-order themes, and then further into even higher-order ones. Through this iterative grouping, meta-themes emerged, that is, broader conceptual categories that captured shared meanings across multiple specific themes.

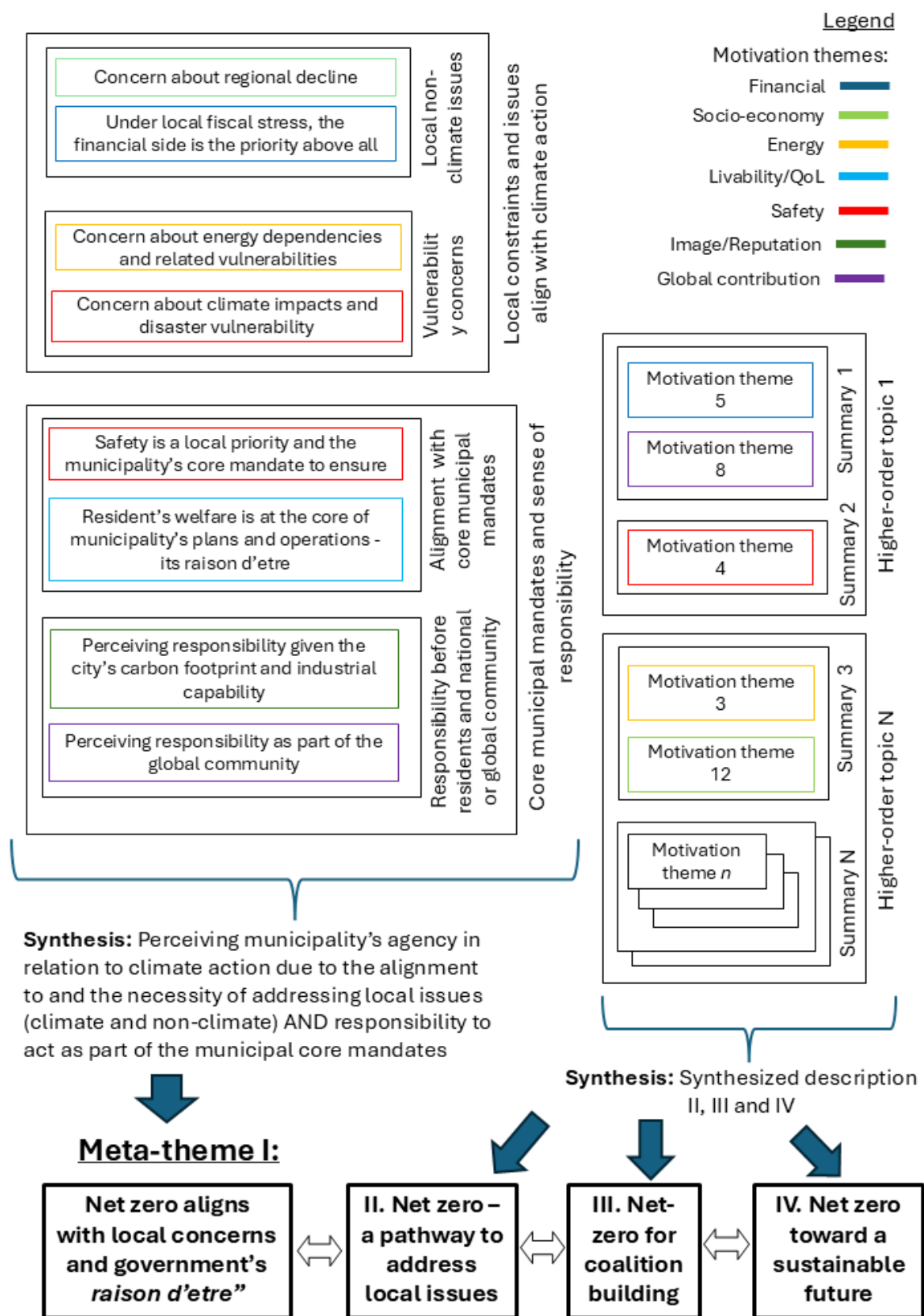
For example, a number of themes revolved around municipalities' concerns about fiscal pressures, socio-economic decline, and vulnerability to disasters, as well as their sense of responsibility to uphold their core mandates, protect residents' safety, and improve welfare. These themes were combined into a higher-order category reflecting *local issue concerns and local/global responsibility*, representing the perception of climate action as a necessary extension of the municipality's core mission and sense of responsibility (Figure 7.1).

A second meta-theme emerged from themes in which municipalities described concrete ways specific climate actions could address local problems. For instance, achieving cost savings, improving energy self-sufficiency, or revitalizing the local economy were perceived as achievable through specific climate actions, such as promoting local renewable energy generation. This reflected an understanding of *climate action as a tool or opportunity to address local challenges*.

A third cluster highlighted the recognition that climate action can serve as a *platform for building consensus and cooperation*, both within the municipal administration and across external stakeholders. Finally, a fourth group of themes referred to a *long-term vision of a sustainable, vital, and resilient city*—an aspirational future that links local well-being with global contribution.

Collectively, these four meta-themes represented a continuum of reasoning—from recognizing the necessity of action, to identifying pathways, to building coalitions, and finally to articulating long-term visions.

Figure 7.1. Concept map of the motivation meta-themes creation



Note: the figure illustrates the process of higher-order theme synthesis, using Motivations as an example. Meta-theme № I creation is shown, while the synthesis of meta-themes № II to IV is shown schematically. The resulting meta-themes are related in a two-way logical chain: one leads to the other, and vice versa. Source: Author.

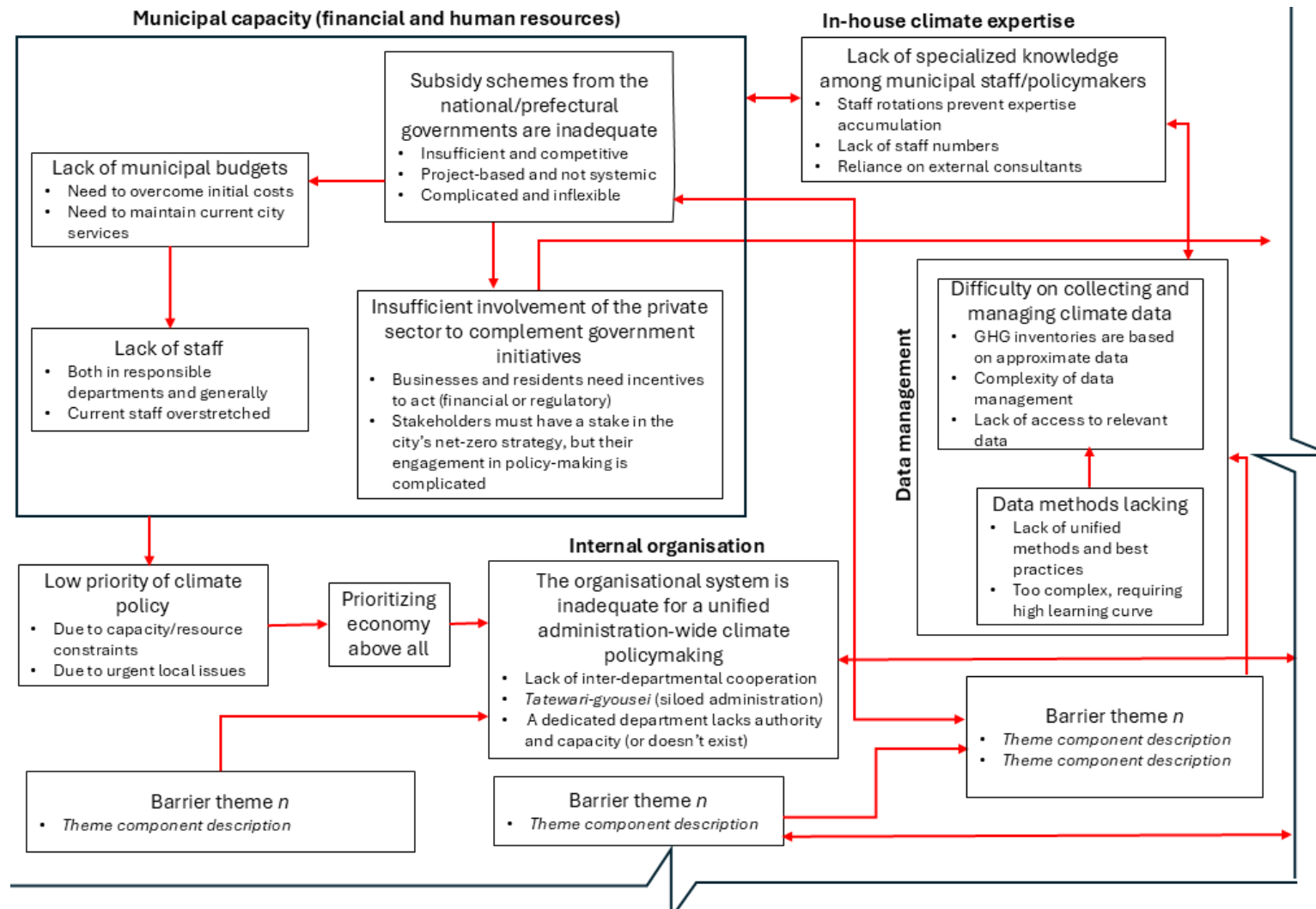
7.2.2 Plotting a bird's-eye view of Barriers, Enablers, and their Interrelations

The analysis of Barriers and Enablers similarly started with plotting all themes on the large blank space for the bird's-eye picture. Stronger emphasis was placed on their interrelations, since, as mentioned in the literature review above, barriers/enablers have an important property of reinforcing each other, therefore necessitating a comprehensive interconnected picture of a web of factors. Thus, potential connections between themes were explicitly mapped using arrows based on two types of evidence. The first came from statistical correlations (Spearman's $\rho \geq 0.4$) identified between the corresponding survey items in Chapter 4, which suggested empirical associations in how municipalities perceive these factors. The second source involved qualitative interpretation (themes), where many quotes in the textual data explicitly mentioned overlapping ideas or conditions that reinforced one another.

While correlation analysis hints at the presence of associations, it does not imply causality. Therefore, the direction of influence between themes was inferred through a combination of qualitative evidence (open-ended responses), logical reasoning, and contextual understanding of municipal governance, informed by my own experience throughout the research process. In some cases, relationships were drawn as bidirectional, reflecting plausible reciprocal reinforcement.

The resulting web of linkages revealed how certain barriers tended to amplify one another, forming vicious cycles of constraint, while relationships among enabling factors indicated virtuous cycles of support. These interdependencies were conceptualized as feedback loops, capturing the inherently dynamic character of local climate governance. At this stage, however, the overall schematic remained overly complex (Figure 7.2).

Figure 7.2. A process of plotting barrier themes bird's-eye schematic for later synthesis



Note: The fragment illustrates an intermediate stage of the synthesis. Due to the large size and complexity of the overall scheme, only a fragment is shown for the sake of illustration of the process. Each rectangle represents a barrier theme (BT-1–BT-17) with its components for clarity. Arrows indicate interrelations among themes based on qualitative evidence or correlation values from the analysis of quantitative survey responses. Source: Author.

7.2.3 Recognizing the Multi-Actor and Multi-Level Pattern

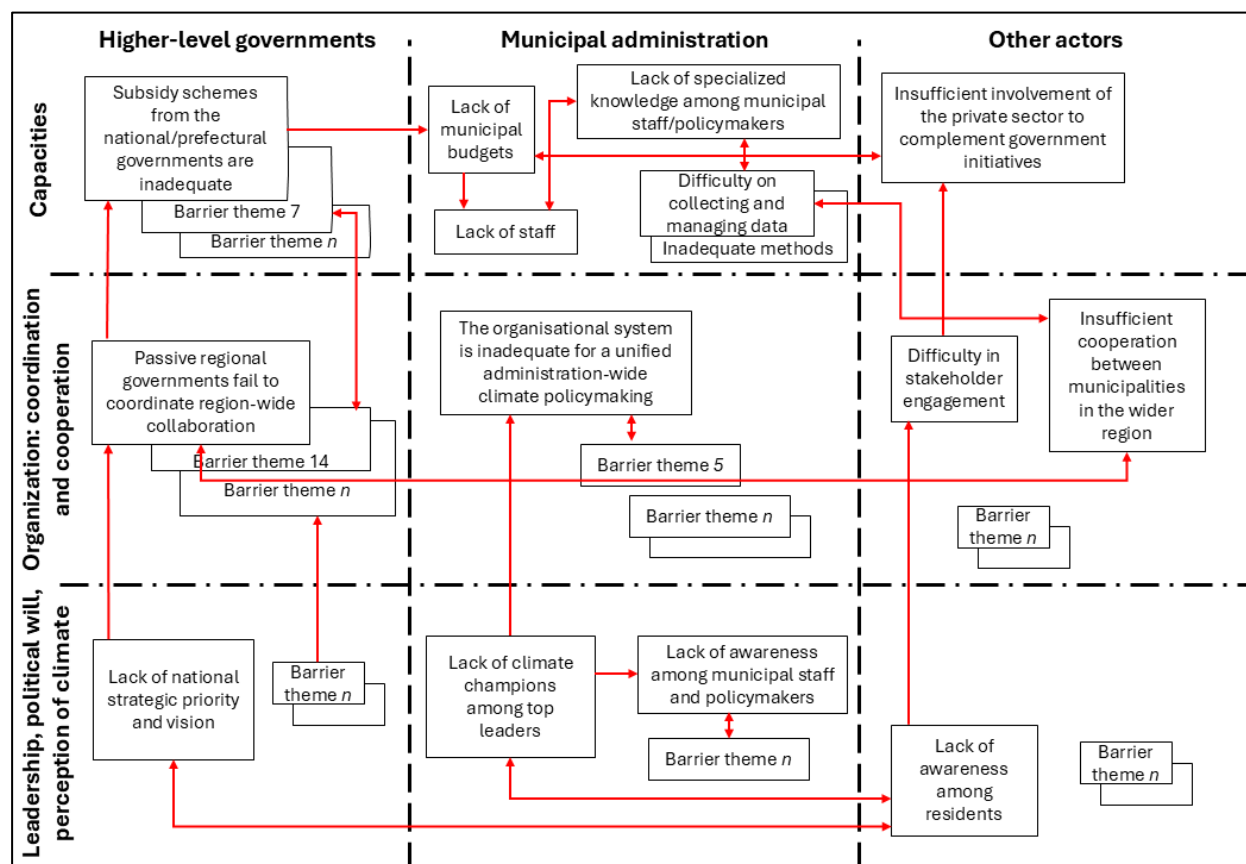
As the network of interconnected themes expanded, it became intuitively clear that the barrier/enabler themes could be meaningfully organized along two dimensions: the actors involved and the levels of governance functions.

As illustrated in Figure 7.3, the horizontal axis represents the actor dimension. The space was divided into three vertical columns distinguishing, from left to right: (1) higher-level governments (national and prefectural); (2) municipal administrations; and (3) other external actors, including the private sector, civil society, academia, and residents.

The vertical axis captures three broad levels of functioning within each actor domain, depicted as three horizontal rows from top to bottom:

- *Capacity*, encompassing financial, human, and technical resources as well as legal authority;
- *Organization and coordination*, referring to institutional coherence, cross-departmental and vertical collaboration, and stakeholder participation; and
- *Political will and climate consciousness*, comprising awareness, prioritization, and leadership.

Figure 7.3. Organization of barrier themes and their interrelations within the 3x3 multi-player and multi-scale model structure



Note: The figure illustrates the process of organizing the plethora of barrier themes (and their interrelations) into a 3x3 matrix, which represented another iteration of the final synthesis. Not all barrier themes are shown for brevity. Source: Author.

In this way, the system was visualized and organized as a 3×3 matrix, where each intersection of actor and governance level contained a distinct cluster of factors (quadrants). Placing all barrier and enabler themes within their corresponding quadrants helped clarify not only where specific barriers and enablers were situated but also how they interact with each other across specified actor scales and governance levels. Thus, the previously overly complex system of barriers/enabler themes and their interconnections has taken shape as a logically organized multi-player and multi-scale model of local climate governance.

7.2.4 From Complexity to Coherence

The initial visualization contained numerous detailed themes and cross-links, resulting in an overly intricate map. At the next stage, unnecessary details were streamlined and conceptually similar themes were gradually merged into broader components within each quadrant. Likewise, the salient feedback loops identified between individual themes were consolidated and represented as major relationships between the quadrants rather than individual themes. Each quadrant was then labeled according to the key components (i.e., original themes) it contained.

As the model took shape inductively from empirical insights to conceptual abstraction, a degree of interpretive judgment was required throughout the refinement of concepts and relationships. This judgment was guided by the broader understanding of local climate governance gained from the literature, as well as by experiences from previous engagements with practitioners and local actors in the field, and insights from the transdisciplinary activities (e.g., the PBR forum) described in Chapter 6.

As detailed in the following Results sub-chapter (Section 7.3), the resulting barrier and enabler matrices emerged as mirrored versions of the same conceptual structure, reflecting the idea that each barrier has a corresponding enabling counterpart. Taken together, the two matrices provide a systemic representation of the interlinked governance dimensions, illustrating how they can either strengthen or weaken local climate action depending on their configuration.

During the synthesis, it also became intuitively clear that motivations play a bridging role within the evolving structure. They primarily act across the lower and middle levels of the barrier–enabler matrices, reinforcing political will, awareness, and consensus-building among actors. In doing so, they help form a stronger foundation upon which the upper “capacity” level (i.e., the resources, expertise, and authority to act) could rest. Moreover, motivations are essential for connecting capacity with action. Even where enabling conditions appear strong and barriers weak, municipal capacities could still be channeled toward other pressing local priorities unless climate action is perceived as relevant or beneficial to the local community and its local concerns and salient issues. In other words, unless actors are motivated to act (that is, unless they realize their interest and agency in acting toward a particular goal), they would not use their capacity to act for

that goal (even if these capacities are sufficient for action). Recognizing this underscores that motivations provide the link that turns potential capacity into purposeful action directed toward net-zero goals.

7.2.5 The Role of the Heuristic

The resulting Integrated Heuristic Model of Local Climate Governance is therefore both a synthesis and a tool. It condenses a large and complex body of evidence into an interpretable structure while remaining flexible enough to be applied diagnostically. The model allows users—whether local governments, researchers, or policy practitioners—to identify how barriers interact, where enabling conditions can be strengthened, and how motivational strategies may reinforce action. Rather than prescribing a fixed formula, the heuristic provides a systemic lens for reasoning about local climate action: one that highlights interdependencies, feedbacks, and potential leverage points for accelerating transitions toward net-zero futures.

The following sections describe the resulting components and logic of the model in detail and illustrate its application, before drawing on the heuristic to derive final recommendations from the overall findings of this dissertation.

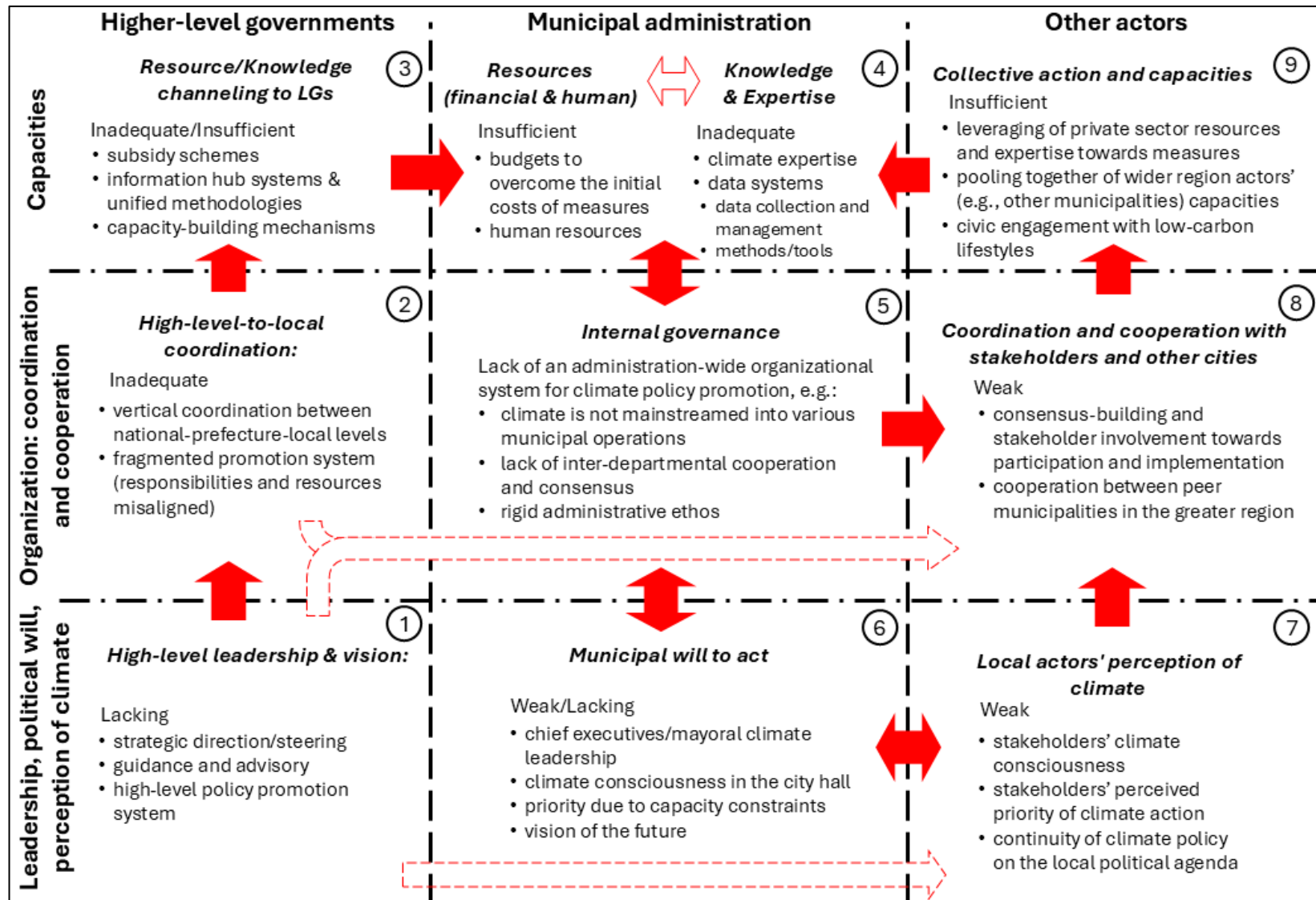
7.3 Results and Discussion: Presenting the Integrated Heuristic Model

Through the synthesis process described above, the final Integrated Heuristic Model of Local Climate Governance (IHM) took shape, comprising three main components: (1) the Barriers and (2) the Enablers 3×3 matrices, and (3) the four synthesized Motivations meta-themes. Together, these components form a coherent and interconnected whole, reflecting the model’s integrative nature and its purpose of linking multiple dimensions of local climate governance within a single systemic framework. The IHM enables users to identify and strategically design governance interventions that can most effectively accelerate municipal progress toward net-zero transitions.

7.3.1 Describing the Barriers Heuristic

The Barriers Heuristic (Figure 7.4) illustrates how constraints to local climate action emerge and reinforce one another across multiple levels of governance and actor domains. It shows that barriers do not act in isolation: each can amplify or be amplified by others through various feedback loops. The figure can therefore be read from many angles. The narrative below unpacks one illustrative reading—how the problem of municipal capacity (Quadrant 4), identified as the most severe barrier in the quantitative survey (see Chapter 4), is interlocked and exacerbated through several overlapping barrier channels. Other interpretations are equally possible, since any barrier, such as leadership, coordination, or public awareness, can be analyzed as a focal point in the same systemic logic.

Figure 7.4. A conceptual representation of major local climate governance barriers in an interlocking 3x3 system



Source: Author's conceptualization based on the empirical findings and literature synthesis presented in this dissertation.

7.3.1.1 The First Pathway: From Fragmented National Systems to Limited Local Capacity (1–2–3–4)

One prominent pathway is represented by the left column of the model. In this channel, weak leadership and limited strategic vision at higher levels of government exacerbate the already poorly aligned vertical coordination between national, prefectural, and local tiers, adding to the overall fragmentation of policy promotion (1-2). This combination results in insufficient and inefficient flows of financial, human, and knowledge resources to municipalities (2-3). Consequently, local governments struggle to build the additional capacity required to advance net-zero initiatives at the local level (3-4).

The qualitative survey responses reveal that many municipalities perceive the current system of support by upper levels of government as fragmented and difficult to use. Typical comments included: “Advancing decarbonization requires significant costs, and the city is struggling with how to secure the necessary funding. Although the national government offers multiple subsidy programs, competition is intense, and they are not easy to utilize.” Others noted that “subsidies have been provided in a ‘point-based’ manner rather than on an ‘area-wide’ basis,” and that “even with subsidies, it would be difficult to make ends meet.” Respondents also pointed to a lack of strategic guidance from higher levels: “We feel that the national and prefectural governments have more or less dumped the responsibility on us, and we are proceeding by trial and error.” Another observed that “there are almost no occasions on which the prefecture coordinates or provides advice on climate change issues,” and that it seems “prefectural officials themselves lack sufficient expertise.”

These responses portray a system in which municipalities depend on national and prefectural direction yet find it fragmented, inconsistent, and poorly aligned with local realities. The issue lies less in the absolute scarcity of funds than in structural issues and the overall inadequacy of the senior-level climate policy promotion system, where resources are not efficiently channeled to build local capacities. Indeed, existing literature notes that while funding for specific climate projects often comes from a variety of sources beyond local governments alone, municipalities themselves almost entirely bear the cost of hiring and maintaining climate-responsible staff (Aylett, 2014). Coupled with this and other studies' findings that the lack of staff and expertise ranks among the most critical barriers to municipal climate action (see Chapter 4 and (Aylett, 2014; Rhodes et al., 2021; Salon et al., 2014)), the picture that emerges is one where subsidies tend to fund individual projects rather than the local capacity needed to sustain them. This is problematic not only because low internal capacity triggers further governance challenges—weak coordination, fragmented planning, and low prioritization (discussed later)—but also because the relationship works in reverse: municipalities, especially smaller ones, lacking human capital and expertise, are less able to access and manage complex subsidy systems.

The crux of the issue, therefore, is not whether subsidies exist or not, but whether they are well-designed, easily accessible in an equitable manner, and supported by broader, coherent policy-promotion mechanisms (including capacity building), which, in turn, are rooted in the overall strategic vision and leadership at higher levels. Indeed, as IPCC Assessment Report (2022) puts it, towards effective climate policies at the local level, far from relying on any single funding scheme, national governments are expected to more systemically “set up enabling conditions for the mobilisation of urban climate finance resource by articulating various goals and strategies, improving pricing, regulation and standards, and developing investment vehicles and risk sharing instruments” (Lwasa et al., 2022).

7.3.1.2 The Second Pathway: Within the Municipal Administration (6–5–4)

A second reinforcing channel pertains to the internal workings of municipal administrations. Here, insufficient capacity (4), fragmented internal coordination (5), and low climate consciousness in the administration, including weak municipal leadership (6) form an interlocking web of constraints. Each of these issues has also ranked highly in the survey’s quantitative findings (see Chapter 4).

Firstly, the link between capacity and organization (4↔5) emerges clearly across various evidence sources: qualitative survey responses, PBR forum discussions, and references in the existing literature. In the survey, many municipalities explained that, with limited staff and tight budgets, their climate teams are too small and overstretched to coordinate effectively across departments. Respondents note that: “Because each department does not understand how its duties are related to climate change, there seems to be a perception that it would simply increase their workload, and thus they are not very cooperative.”, and that “Although the city has declared its aim to achieve carbon neutrality by 2050, at present it does not have an organization that can address climate change issues across the entire administration.” Staff rotation (also a consistently raised issue) also prevents the accumulation of expertise, leaving climate policy work to generalists who are unable to build long-term institutional memory.

This dynamic works both ways. When coordination across departments is weak, even the limited human and financial resources that exist are not used efficiently. Departments compete for scarce funds rather than pooling them toward common goals. The ICLEI Japan representative, reflecting on the survey results during the PBR Forum, has touched upon this problem:

“Some local governments responded about the lack of budget and expertise, but this is often answered only by the departments in charge of climate change. It does not mean that the local government itself lacks budget, but that environment departments do. If we open up the climate agenda to economic or infrastructure divisions, we can see many projects already implementable within the budgets that are already distributed.”

This observation underscores that the main obstacle is not simply the shortage of resources, but their fragmented allocation and weak integration into a unified, administration-wide approach to climate action. In many municipalities, climate measures remain peripheral—added as secondary components to departmental projects rather than pursued as a coordinated policy goal. Other local climate governance studies echoed this dynamic, noting that overcoming barriers is “less a matter of creating new capacity than of facilitating the effective use of existing resources,” adding that “factors other than capacity are at play” and point out that addressing the issue “may be not as simple as allocating additional funds, developing new technologies, or training a more sophisticated workforce” (Burch, 2010a, 2010b). In this sense, the challenge is not only to secure additional funds or staff, but to reshape internal systems and routines so that existing capacities can be applied collectively and strategically toward climate goals. Moreover, inadequate cross-departmental coordination was ranked among the top barriers in the survey (see Figure 4.4). The (4) and (5) quadrants of the heuristic model thus capture the structural core of municipal constraint: the inability to channel fragmented resources into strong municipal capacity for action.

The relationship between organization and leadership (5↔6) adds another dimension to this internal cycle. Many municipalities in their responses pointed to a lack of strong, visible leadership as a key factor limiting progress. One quote mentions: “Given the weakness of horizontal linkages, top-down decision-making is the quickest and most reliable way to ensure implementation—but it is lacking.” The authority and decisiveness of municipal leaders are crucial for fostering consensus within the administration. Existing studies similarly note that “without clearly articulated priorities and an encompassing vision, the municipal staff function without the permission (and inspiration) to act effectively on climate change” (Burch, 2010a), while mayors’ enthusiasm often stands behind inspiring pioneering projects (Myasoedov & Ota, 2021). In addition, overall skepticism and low awareness across the entire administration (a top-ranked barrier in Category IV; see Figure 4.5) may further stifle consensus and coordination efforts.

Finally, the lack of municipal will to act (Quadrant 6) is also closely tied to limited capacity: when budgets are tight, and expertise is scarce, policymakers struggle to advance their proposals without convincing evidence. In such circumstances, political leaders find it difficult to gain support for ambitious policies, as climate action appears vague and unfeasible, leading instead to the prioritization of familiar issues that seem more urgent and achievable.

7.3.1.3 *The Third Pathway: Societal Engagement and Collective Capacity for Action (7–8–9–4)*

The third pathway, represented by the right column of the heuristic model, highlights the barriers arising from the societal dimension of local climate governance. This channel demonstrates how limited action by various non-state actors—citizens, businesses, civil society, and neighboring municipalities—restricts the scale and scope of local climate initiatives. In practice,

weak collective action and capacities (9) leave municipalities acting largely on their own (9→4), with limited means to achieve their ambitious net-zero goals.

Municipalities responding to the survey have repeatedly emphasized that decarbonization cannot be accomplished by the government alone. As one stated, “The efforts of each business operator are indispensable for the decarbonization of the city area.” Another noted that, while households and small companies are increasingly aware of environmental issues, “voluntary initiatives remain limited.” When external actors' participation is low, municipal projects risk remaining symbolic and limited in scale. The importance of broader citizen action is well recognized in the climate governance research and practitioner community. For instance, one policy researcher from the environment research institution commented at the PBR Forum that “without involving the real people on the ground, zero-carbon goals are so ambitious and cannot be achieved.” In one way or another, the effectiveness of municipal capacity (4) ultimately depends on the mobilization of societal capacity (9).

Yet, collective capacity (9) cannot emerge without effective coordination and cooperation with and among stakeholders (8). Both quantitative and qualitative survey results converge on the importance of stakeholder engagement for effective climate action. Municipalities cite persistent challenges in engaging diverse actors with “different directions and areas of expertise” and in uniting them “toward the same goal.” Many noted the lack of mechanisms not only to build consensus with residents and businesses but also to coordinate region-wide action with neighboring cities. One respondent observed that “many municipalities are pursuing measures on their own, but these measures are likely to hit a ceiling,” emphasizing the need for “close cooperation with the prefecture and neighboring municipalities” to manage energy systems at a broader scale. The 2→8 relationship thus becomes critical: without prefectural facilitation, region-wide collaboration remains underdeveloped. The same holds true internally—municipalities that have not reached internal consensus across departments find it difficult to engage stakeholders externally, as they lack a clear, unified message and a coordination system to rely on when deliberating with the community (5→8). Furthermore, the lack of a unified, clear message and vision from higher-tier governments similarly stifles municipalities' stakeholder engagement efforts (1→8).

Underlying these coordination barriers is the broader challenge of insufficient public awareness of the urgency and need to engage in climate action locally (7). In the survey, many municipalities described low citizen understanding and a limited sense of urgency around climate action. Respondents mention that “Resident demand for measures against global warming is currently low,” and that climate change “is difficult for residents to feel in their daily lives,” and that while it is considered “important,” its “priority is low.” When climate awareness and policy demand are weak, municipal efforts to foster stakeholder engagement falter (7→8), and society's collective energy remains untapped (9).

Public awareness (7) is itself influenced by political signaling and leadership at both the local (6) and national levels (1). At the local scale, low civic demand feeds into weak political will (7→6), as elected officials remain passive to the climate agenda when they perceive little demand and urgency for climate policy from the residents. Indeed, as one response mentions: “If residents’ demand were to increase, politicians would reconsider their stance, but we have not reached that point yet.” Existing literature similarly mentions that the perception of public demand by the local politicians influences their decision to “use scarce financial and human resources (which could be directed towards any one of the municipality’s many priorities)” (Burch, 2010b). Conversely, the absence of advocacy and proactive climate communication by top municipal leaders fails to raise community awareness and foster civic pride in the city’s forward-looking environmental agenda (6→7). Nationally, the absence of a persuasive long-term vision and consistent awareness-raising from senior government levels (1→7) weakens the political and social framing of climate issues across constituencies, reducing public engagement overall.

Together, these links form a cascade of reinforcing constraints: limited awareness (7) undermines stakeholder cooperation (8), which stifles collective capacity (9), leaving municipalities with only their own limited capacity to act (4). The result is a governance system where expectations for societal engagement with the climate issue are high¹⁸, yet mechanisms to cultivate it remain inadequate. The literature on social dimensions of climate governance supports this pattern, noting that local problem awareness often mirrors the low prioritization of climate at higher levels (Eisenack et al., 2014), and emphasizing that genuine progress depends on community ownership—where stakeholders not only support but co-create the low-carbon transition (Burch, 2010b; Moore, 2012).

7.3.1.4 From Complexity to Coherence: Understanding the Systemic Dynamics of Barriers

The three pathways described above—(1–2–3–4), (6–5–4), and (7–8–9–4)—operate simultaneously and intersect. The municipal capacity barrier (4), used here as the analytical focal point to unpack these relationships, is not an endpoint in itself. As the diagram shows, capacity both reflects and reinforces many of the other barriers within the system. Indeed, any quadrant could serve as the starting or ending point of analysis. For instance, if one were to begin with the barrier of weak coordination and cooperation with stakeholders and other cities (8), it would be seen as influenced by community awareness (7), by the municipality’s own internal organization (5), and by the insufficient facilitation of wider regional collaboration by higher-level governments (2). These, in turn, are affected by other factors in the matrix. The heuristic, therefore, does not prescribe a linear causal chain or assign responsibility to any single actor or governance level; instead,

¹⁸ As the government hopes for more active and independent action from the civil society and private sector

it reveals a system of mutual dependence, where each barrier interacts with others in an interlocking web of feedback loops.

This systemic interdependence echoes what the literature on local governance has long stressed. Scholars caution that “different barriers cannot be understood in isolation,” where some can “give rise to and magnify other barriers” thereby stressing the necessity of “understanding how barriers are related to each other” (Eisenack et al., 2014). Similarly, some emphasize that “simply providing more funding” will not fill the action gap when local administrations lack the capacity to access or manage those funds, nor can any single actor “make sufficient progress alone” (Moser et al., 2019). Others likewise argue that barriers are “deeply interwoven phenomena” embedded in institutional and cultural systems, producing inertia even in resource-rich municipalities unless internal structures and norms are reoriented toward cross-sectoral cooperation (Burch, 2010b).

The Barriers Heuristic thus exposes not a single cause but an interlocking web of constraints that stifles progress toward net zero. The most salient barriers—such as the shortage of funds or expertise—are both cause and symptom of a deeper systemic condition in which inadequate higher-level support, weak leadership, fragmented coordination, and limited societal engagement all add to the issue and reinforce one another. This understanding also helps explain why narrowly focused interventions, such as introducing a new subsidy program, are unlikely to address the systemic nature of the issue: each measure addresses only one node in a larger network of dependencies. Instead, the interlocking web of obstruction must be targeted at multiple points.

Recognizing this interdependence also challenges the common tendency to focus primarily on capacity deficits as the core problem. While capacity remains the most salient and visible barrier across municipalities—confirmed by both this study’s quantitative findings (see Chapter 4) and other large-scale surveys in the literature (see Section 7.1.1)—it is only one part of a broader system. Even municipalities with relatively strong internal capacities can see their progress constrained if external cooperation (i.e., the right column of the 3x3 matrix in Figure 7.4) or higher-level policy alignment (the left column) remains weak. Conversely, a municipality can have a strong civil society actively involved in climate action (the right column), and similarly, supportive national frameworks may be in place (the left column). Yet, those will still be insufficient and inefficient if the municipal internal promotion systems and leadership (the central column) are inadequate, thereby failing to bridge the capacities of other actors with the municipality’s own capacity.

The lesson emerging from this synthesis analysis is that overcoming interlocked barriers requires multi-channel strategies that act simultaneously across governance levels and actor groups. Breaking one link in isolation is unlikely to shift the system as a whole. Instead, progress depends on the collective strengthening of multiple enabling conditions—leadership, coordination, participation, and coherence (see the following Section 7.3.2)—whose combined effect can

gradually dismantle the intertwined web of barriers. As Denton et al. (2022) in the IPCC's Sixth Assessment Report observe, sustainable transitions require moving “beyond ‘rational’ assessments of the costs and benefits of policies” towards involving actors “at all levels,” thus making it possible to overcome “multiple barriers” (Denton et al., 2022). Indeed, this becomes apparent in this framework, which clearly shows the interconnected nature of barriers embedded in a web of self-reinforcing feedback loops.

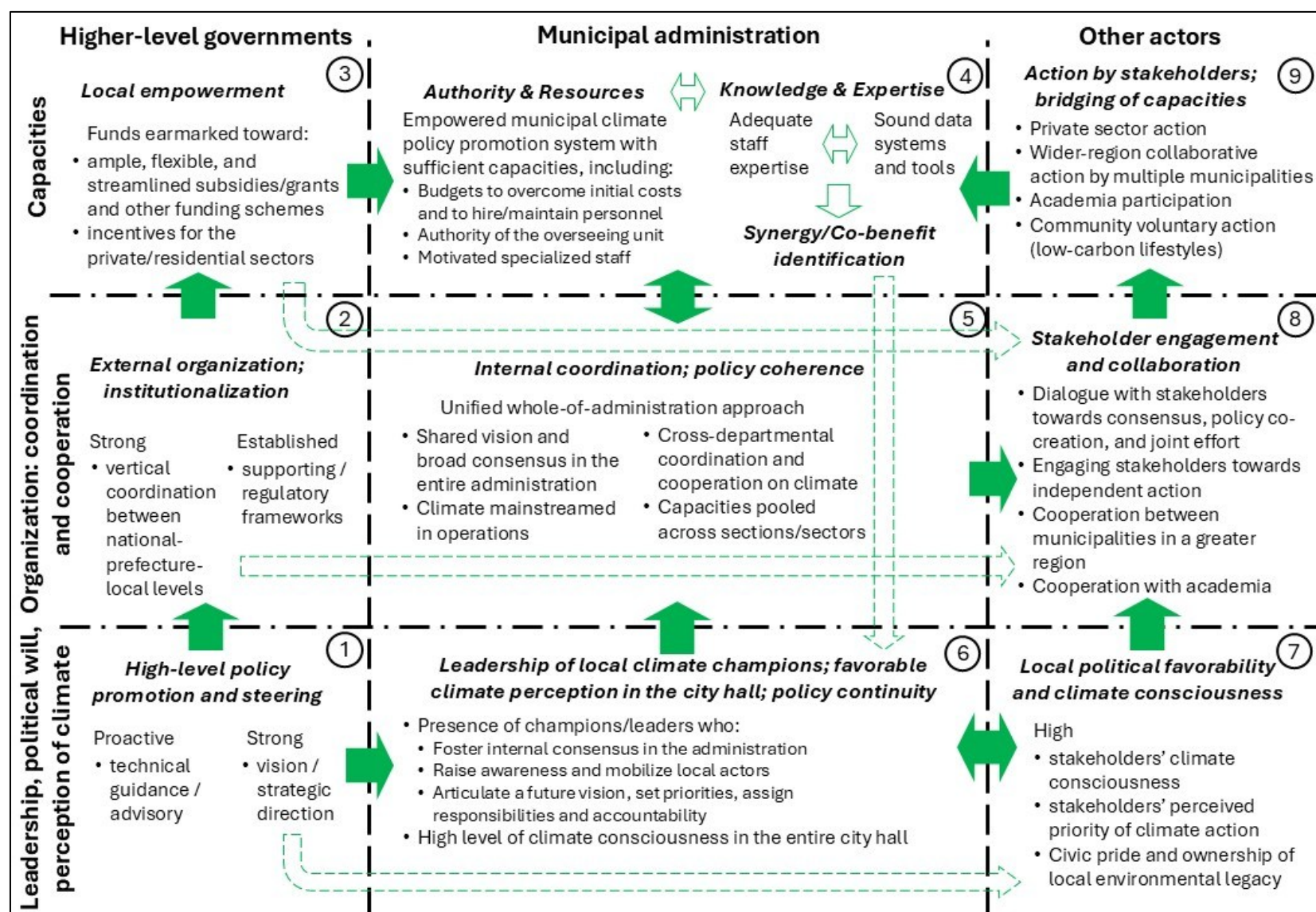
The following section introduces the Enablers Heuristic, which mirrors the structure of the barriers model but inverts its logic. It illustrates how negative reinforcing relationships can be turned into virtuous cycles, where improvements in one area amplify progress in others. Understanding these positive feedbacks—how enablers strengthen each other across levels and actors—offers practical insights into how municipalities and their partners can strategically convert the current web of negative constraints into a dynamically reinforcing positive system of support, driving steady progress toward net-zero cities.

7.3.2 Towards Overcoming Barriers: Introducing the Enablers Heuristic and its Usage

Having established the systemic and mutually reinforcing nature of barriers, the next step is to consider how these feedback loops might be reversed or transformed into enabling dynamics. The Enablers Heuristic serves precisely this purpose. It repeats the 3x3 structure of the Barriers model, but with inverted logic: instead of illustrating how obstacles reinforce inertia, it shows how different enabling conditions can strengthen one another, creating positive feedback loops that accelerate progress toward net-zero objectives (Figure 7.5).

While the Barriers Heuristic above provided a detailed description of the model and its interrelations, the focus here shifts toward how the heuristic can be used—illustrating its practical application rather than re-describing its structure. The practical value of the heuristic lies in its *configurational* nature. It helps users identify various combinations of factors—across governance levels and actor groups—that can work together to overcome a given constraint. As Ryan (2015) observed, much of the literature on urban climate governance falls into the “everything matters trap,” producing long lists of relevant variables without assessing how they combine in practice. He therefore calls for a more “configurational approach”, one that allows “different and alternative combinations of conditions” to be identified, acknowledging that “the effect of any particular condition may depend on the presence or absence of others”(D. Ryan, 2015). The Barrier/Enabler Heuristic directly responds to this call. It enables both researchers and practitioners to map out multiple pathways—configurations of interlinked enablers—that can collectively shift a city's governance system from inertia to action.

Figure 7.5. A conceptual representation of major local climate governance enablers in a 3x3 system with multiple self-reinforcing loops



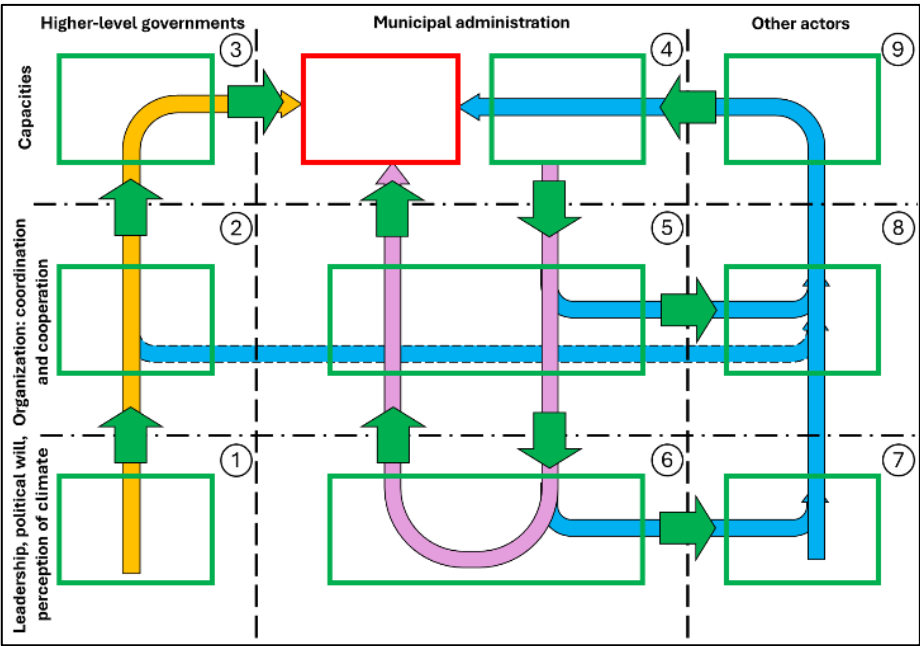
Source: Author's conceptualization based on the empirical findings and literature synthesis presented in this dissertation.

While all municipalities are subject to similar archetypal barriers and enablers, their relative importance varies depending on local contexts. The heuristic should therefore be read not as a fixed prescription but as a diagnostic and design tool. It helps users visualize which enabling factors can be most effectively strengthened in their own local situation, and through which channels. To illustrate this, the following subsections present several hypothetical examples of how the heuristic could be applied. Each begins by picking up a certain salient barrier identified through the survey earlier (see Chapter 4), finding its position on the Barrier Heuristic, and then turning to the Enabler Heuristic, where it is possible to trace several reinforcing pathways that can help strengthen the enabler (the one that corresponds to the barrier in question) and hence eventually helps to overcome it. In this way, the examples below bridge theoretical insight and practical application, showing how the heuristic can guide both strategic planning and future research. Furthermore, the examples are analogous to policy recommendations, since—although hypothetical—they are grounded in empirical evidence from this research (e.g., the large-scale survey in Japan and its qualitative and quantitative analyses) and triangulated with relevant literature.

7.3.2.1 Addressing Municipal Resource Capacity Limitations

The first example of the model usage focuses on the barrier most frequently cited in the survey: *insufficient municipal resources and staff capacity*. This barrier, located in Quadrant 4 of the model, corresponds in the Enablers Heuristic to the enabler of *adequate resources, skilled staff, and an empowered climate division with authority and remit*. Strengthening this enabler can occur through several mutually reinforcing pathways that connect different parts of the matrix (Figure 7.6).

Figure 7.6. A schematic of potential enabling pathways towards addressing municipal resource capacity



Note: The schematic should be read together with Figures 7.4 and 7.5. Arrows illustrate potential pathways addressing a barrier (red rectangle) through reinforcement and taking advantage of enablers (green rectangles). Three such pathways are described in the text (orange - Channel 1, pink - Channel 2, and blue - Channel 3), however, these examples are non-exhaustive, and other pathways can also be drawn. Source: Author.

Channel 1: Strengthening enabling conditions at higher government levels (1→2→3→4)

At the national and prefectural levels, local capacity can be enhanced through clearer *strategic direction* (1), better *vertical coordination and institutional frameworks* (2), and more *effective funding and knowledge flows* (3). As municipalities in the survey observed, “it will be important to enhance the subsidy system of the national and prefectural governments,” and “promoting adequate climate action requires a nationwide framework commensurate with that scale.” Indeed, the IPCC’s Mitigation of Climate Change report notes that “national governments are expected to set up enabling conditions for the mobilisation of urban climate finance resources by articulating clear goals and strategies, improving regulation and standards, and developing investment vehicles and risk-sharing instruments” (Lwasa et al., 2022). For a highly centralized fiscal system such as Japan’s (ESCAP/NEASPEC, 2021; UNCRD, 2014), these top-down channels can have significant leverage. However, they are often beyond the immediate reach of municipal officials; hence, the heuristic also directs attention to internal and societal pathways where municipalities can act more directly.

Channel 2: Mobilizing internal capacities through synergies and leadership (4↔5↔6)

Within municipalities, capacity constraints can be mitigated by identifying synergies—policy areas where climate action aligns with existing local priorities such as economic

revitalization, disaster prevention, or public health. As one respondent explained, “Measures to combat global warming can be promoted by linking and synergizing with other projects, leading to solutions to various issues.” Recognizing such co-benefits reframes climate policy from being an additional burden to a shared opportunity, encouraging cooperation across departments.

This is what Moser et al. (2019) describe as overcoming the “siloed government syndrome,” in which fragmented mandates and rigid procedures hinder collaboration. They note that progress depends on “shifts in narratives to shared opportunities” as well as “attain[ing] some level of importance or priority” to elevate climate on the local political agenda so that climate measures can compete with other demands. When framed through co-benefits, climate action becomes politically and administratively feasible.

In the same vein, the presence of proactive climate champions (mayors, department heads, or influential officials) can further amplify this effect by building consensus and using these synergies to promote cooperation across departments. As one survey participant remarked: “When the mayor sets a clear direction ... it makes it possible to drive policies forward.” Existing literature similarly emphasizes the importance of champions, particularly in the early stages, which are often “driven and led by a few committed individuals ... who create the necessary action space for other actors” and who, with their visionary leadership, contribute to a “significantly changed context for decision-making” (Eisenack et al., 2014)

These internal processes reinforce one another: with existing capacities and recognized synergies (Quadrant 4), the core climate team may engage other departments and promote organization-wide coordination (Quadrant 5) (4→5), which, in turn, strengthens leadership and political will (Quadrant 6) (5→6). Together, they build the institutional foundation for more efficient resource use, thereby addressing the original capacity constraint (6→5→4).

Channel 3: Expanding capacity via societal engagement and co-production (7→8→9→4)

Municipal capacity can also be expanded externally by engaging other societal actors—businesses, residents, academia, and other municipalities. Several respondents emphasized this point: “The efforts of each business operator are indispensable for the decarbonization of the city area,” and “Public–private partnerships are indispensable for decarbonization.” Existing literature also notes that by fostering an environment conducive to private-sector investment, cities can “attract capital, drive economic growth, create jobs, and ensure progress toward climate goals” (Bunsell et al., 2023, p. 92)

Partnerships with universities and research institutions can further strengthen the knowledge dimension of capacity by providing data systems, analytical tools, and evaluation methodologies that many municipalities lack. Such cooperation helps local governments make sense of complex data and back their policy proposals with evidence—an indispensable precondition for

building internal consensus. As one speaker from Latin America at the PBR forum remarked, one of the reasons why Curitiba city in Brazil had successfully implemented some of its internationally acclaimed urban sustainability measures (e.g., the world's first Bus Rapid Transit system) was because the city had a long-standing partnership with the Institute of Research and Urban Planning of Curitiba which contributed to a single and integrated urban planning.

In parallel, regional cooperation among neighboring cities can pool resources and create efficiencies of scale. As one city remarked, "Rather than taking action only in small local areas, more efficient countermeasures can be achieved by working across the entire surrounding region."

Civil society participation is equally important. Engaging residents and community groups not only expands financial and human resources but also builds local legitimacy and public support for ambitious policies. In this sense, the combined capacities of the non-state actors (in the right column of the matrix)—private, civic, academic, and regional—feed directly back into municipal capacity (9→4).

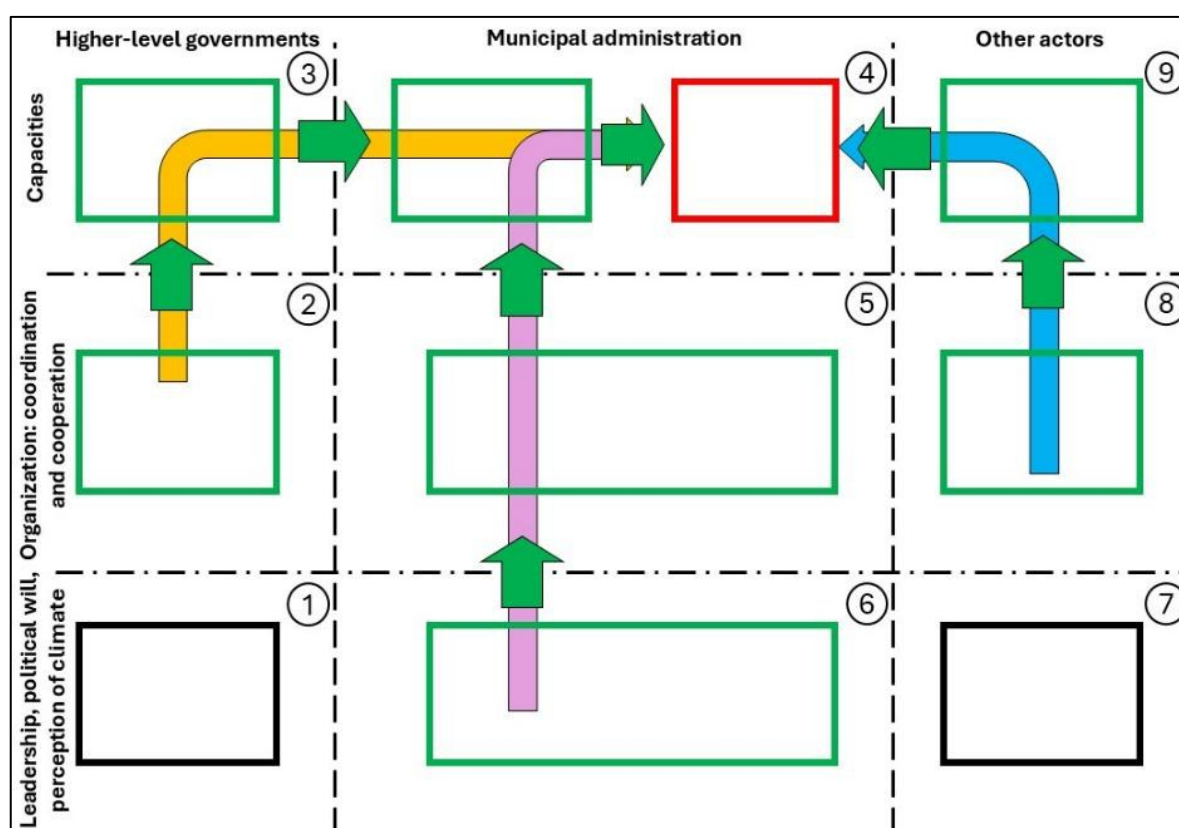
Summary of the enabling channels addressing municipal capacity (resource) limitations

The mechanisms described above demonstrate how the Barrier/Enabler Heuristic can be used to identify multiple reinforcing routes—some top-down, others bottom-up; some internal, others external—that collectively target the key barrier of constrained municipal resources. This approach does not propose a single solution but rather flexible configurations of several mutually supportive strategies that can be adapted to local contexts. In this way, the heuristic serves as a simple, intuitive tool to help municipalities and policymakers identify strategies that leverage several enablers simultaneously to address a critical barrier. To give a sense of how other key barriers could be addressed using the tool, the sections below outline some examples. Since my focus here is to illustrate the use of the framework rather than describe all potential pathways, further examples below are not exhaustive and are presented in a more compact form than the first example.

7.3.2.2 Addressing Municipal Knowledge and Expertise Limitations

A second important constraint concerns the limited knowledge and expertise available within municipal administrations—another core component of capacity in Quadrant 4. While the barrier is often less visible than financial shortages, it undermines municipalities' ability to design, evaluate, and implement coherent policies. Although a variety of reinforcing pathways can be traced using the Enablers Heuristic to address this barrier, this section outlines a few potential channels for illustrative (non-exhaustive) purposes (Figure 7.7).

Figure 7.7. Potential enabling pathways addressing municipal knowledge/expertise



Note: The schematic should be read together with Figures 7.4 and 7.5. Arrows illustrate potential pathways to address a barrier (red rectangle) by reinforcing and leveraging enablers (green rectangles). Few pathways are described in the text to illustrate the use of the heuristic, but other pathways can be drawn. Source: Author.

One can identify a potential pathway involving learning through horizontal exchange (8). Many respondents emphasized that participation in inter-municipal or network platforms helps build practical knowledge and confidence: “It is important to gather information and know-how via inter-municipal networks; this can readily provide the building blocks for designing the policies that municipalities should pursue.” Networks (whether national, regional, or transnational) allow smaller municipalities to adapt tested approaches, share best practices, develop and adopt collective methodologies, tools and other knowledge products. Further, there is space for academic and expert collaboration (8). Universities and technical institutes can supply municipalities with analytical tools, data management systems, and methodological support that city officials rarely have time or capacity to develop themselves. As Betsill and Bulkeley (2007) observed, academic partners can “play a crucial role in facilitating local climate action” by bridging the gap between scientific research and policy design. By co-producing data and applied knowledge, such partnerships convert external expertise (9) into internal learning (4).

Internal organisational coherence in the municipality (5), as well as political will of local leaders (6) contribute to channeling resources towards internal capacity building, including staff

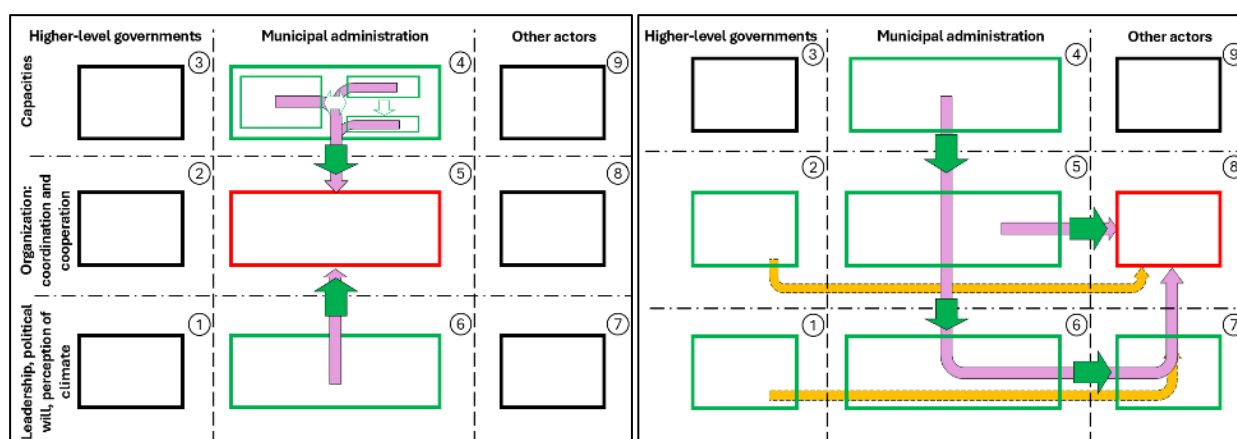
expertise (4). Another pathway involves higher-level investment in learning and staff development (2). Both survey responses and existing literature note that while national subsidies finance projects, they rarely fund people (Aylett, 2014). Including training, data systems, or specialist hiring as eligible components of subsidy schemes would create lasting in-house human capacity rather than one-off project support terminating upon project completion.

Together, the above several (but non-exhaustive) illustrative scenarios outline how peer learning, expert partnerships, and deliberate investment in human capital can reinforce one another to address the knowledge deficit and build institutional learning and expertise.

7.3.2.3 Strengthening Internal and External Coordination

Further areas where the heuristic offers valuable guidance concern coordination, both internally (5) and externally (8). Poor coordination often stems from fragmented mandates and a lack of bridging mechanisms, but the heuristic helps reveal where reinforcing levers may exist (Figure 7.8).

Figure 7.8. Potential enabling pathways addressing internal (left) and external (right) coordination



Note: The schematic should be read together with Figures 7.4 and 7.5. For brevity, not all potential pathways are shown. Source: Author.

One pathway emphasizes empowering the climate division in the municipal structure as a strategic convener. With sufficient resources and knowledge, climate units can move beyond technical management to facilitate collaboration across departments (4→5). As one respondent explained, “By expanding the organizational structure of environmental policy, it is possible to strengthen cooperation with other departments and promote it comprehensively.” This reflects what Aylett (2015) calls the role of climate teams as “negotiators of space for the climate agenda” where they negotiate to *carve out space* for climate action within the broader landscape of urban priorities—using concrete projects to build coalitions of support. If available, climate managers may leverage synergy and local framing narratives, as well as data evidence in accessible forms

(e.g., visualizations, data-backed stories, and assessments) to support their arguments in their consensus-building efforts.

Another pathway relies on leadership signals (6). When mayors and senior executives express clear intent and back it with evidence, they provide the political mandate necessary for departments to align their work (6→5). Many respondents noted that “top-down decision-making is the quickest and most reliable way to ensure implementation,” highlighting how visible leadership can lower the hurdle to interdepartmental cooperation.

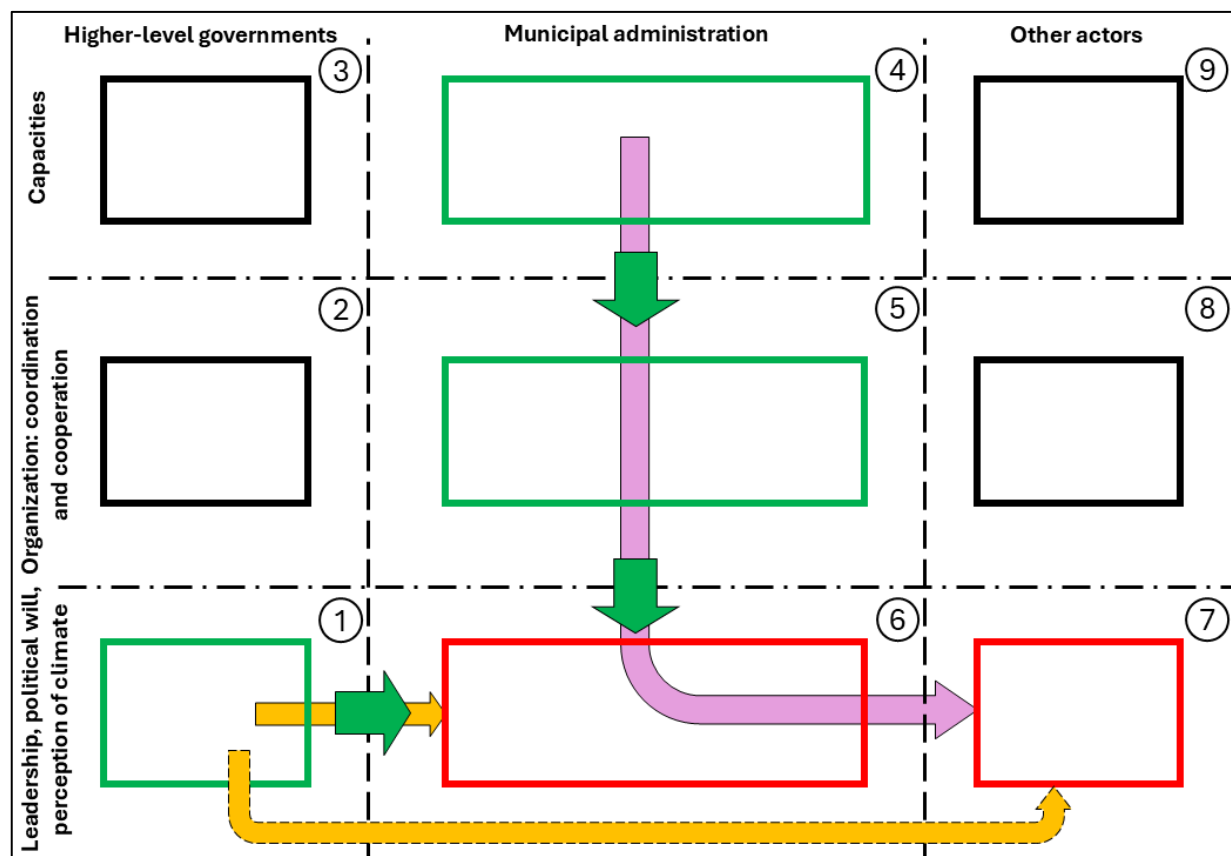
Multiple enabling pathways can be traced to address weak consensus and cooperation with external stakeholders (businesses, residents) or coordinating with other municipalities in the region (8). Internal coherence strengthens a municipality’s ability to engage consistently with external stakeholders (5→8), while prefectural coordination fosters cooperation across regions (2→8). One city summarized this need succinctly: “Rather than taking action only in small local areas, more efficient countermeasures can be achieved by working across the entire surrounding region.” Leadership and advocacy by political leaders (both at the local and higher levels) (1,6), ideally backed by strong locally-tailored messaging, including relevant data-backed assessments and co-benefits narratives (4), can build awareness and receptiveness of local communities (7), preparing the ground for action engagement and partnerships (8).

In this sense, internal alignment (within the local administration) and external coordination (stakeholder engagement/regional collaboration) are two sides of the same enabling process—one that connects organizational coherence inside city halls with collective action across municipal boundaries.

7.3.2.4 Raising Awareness and Political Salience within City Hall and the Community

The final set of examples highlighting potential enabling pathways illustrates those that may target the low awareness and weak political salience of climate action—both within municipal administrations (6) and in the community (7). One could see how the heuristic clearly illustrates that such an awareness/priority dimension depends on both a coherent internal policy-promotion system and a strong national/regional strategic vision (Figure 7.8).

Figure 7.9. Potential enabling pathways addressing awareness and priority in the city hall and community



Note: The schematic should be read together with Figures 7.4 and 7.5. For brevity, not all potential pathways are shown. Source: Author.

One pathway focuses on existing internal capacities (4) and the institutionalization of climate policy within administrative systems (5). Embedding climate functions in formal routines—through dedicated divisions, reporting requirements, or cross-sectoral committees—helps *institutionally cement* climate policy within the municipal administrative system and protect it from the volatility of political cycles. As scholars argue, institutionalization enables local climate policy to “overcome party politics and political timetables” and keep momentum despite the loss or change of individual champions (6) (Bulkeley et al., 2009; Sippel & Jenssen, 2009).

That pathway also underscores the power of locally framed communication and co-benefits. Technical phrases such as “net zero” often fail to engage wider audiences. As climate communication scholars note, such terms can be “opaque or misunderstood by general audiences” (Sippel et al., 2022). Communicating what these goals mean for people’s daily lives—cleaner air, safer streets, and economic revitalization—makes climate action relatable. In this way, a clear municipal plan that simultaneously links climate goals with local sustainability goals may circumvent risk-averse or passive local leaders who hesitate to invest their political capital in climate, while still appealing to broader audiences (4,5→7).

Another pathway reflects vertical signaling and public education. A clear national or prefectural vision (1) can elevate local awareness by framing climate action as a collective societal goal (1→7). Strong national signaling also naturally influences local politics (1→6). Respondents frequently pointed out that “achieving carbon neutrality requires strong impetus and cannot be achieved without national political leadership based on a long-term vision.” Similarly, the contribution of academia through education and outreach helps shape social norms and expectations that sustain public engagement. A professor at Tokyo University and former deputy director of the National Institute for Environmental Studies, speaking at the PBR forum, has emphasized the important roles of citizen groups and youth. In that regard, she highlighted the crucial role that state media (TV, newspapers, etc.) play in exposing mass audiences to climate change information, inviting the forum’s audience to ponder on “the consequence between people’s decreasing awareness on climate change and how less Japanese people hear about climate change [in the Japanese media]”.

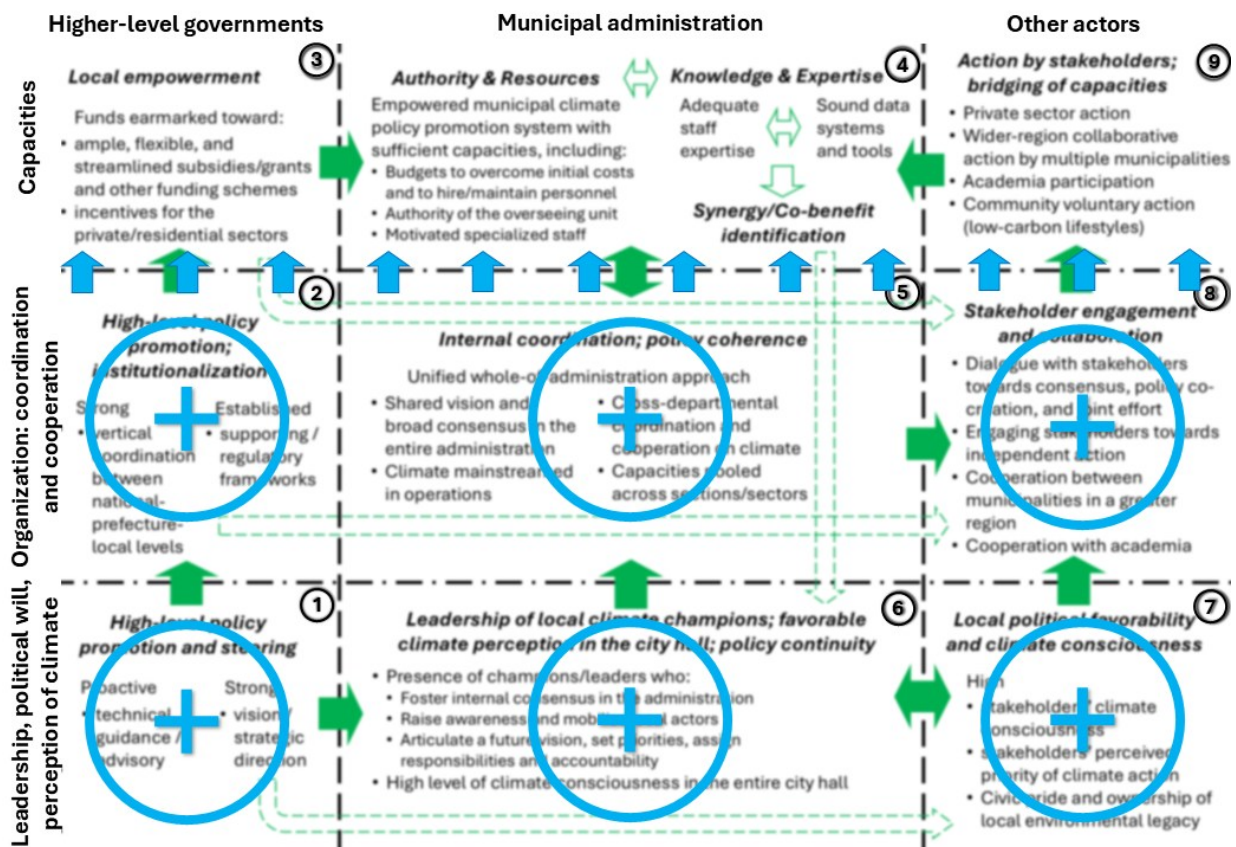
7.3.3 Completing the Picture: The Role of Motivations

The final element completing the Integrated Heuristic is the Motivations dimension, which connects and animates the entire system. In the conceptual architecture of the model, motivations occupy a distinct yet integrative position: they operate both *within* the system—by reinforcing enablers and lowering barriers—and *around* it—by acting as a translation mechanism that turns capacity and potential into purposeful action, providing direction toward the goal of net-zero.

7.3.3.1 Motivations as reinforcing enablers and lowering barriers

Motivations can be strategically leveraged to strengthen the enabling environment of local climate governance, particularly by enhancing the “political will” and “coordination” dimensions (corresponding to the middle and lower levels in the Enablers matrix), thus supporting the upper “capacity” level (Figure 7.10). Through a reinforced enabling environment, motivations help loosen the grip of the interlocking web of barriers that often constrains municipal action.

Figure 7.10. The enabling role of motivations



Note: The schematic should be read together with Figure 7.5. Source: Author.

As discussed throughout this dissertation, municipalities' pursuit of net-zero objectives is rarely driven by climate goals alone. Rather, it is embedded in a broader set of local aspirations—economic revitalization, quality of life, safety and disaster resilience, civic pride and leadership, and contribution to global efforts. These motivations underscore the local relevance and co-benefits of climate action for diverse actors and constituencies. When strategically emphasized in policy communication and decision-making, they can transform climate action into a shared municipal project that aligns environmental ambition with everyday governance concerns.

Within the heuristic, these motivational framings help reinforce multiple enabling quadrants (and hence overcome the barriers). For example, when local leaders perceive climate action as an avenue for economic revitalization or an improved quality of life, they are more willing to advocate for it politically. This fosters local climate champions and favorability toward the climate agenda at the top municipal levels (Quadrant 6), which in turn helps reinforce other proximate enabling factors—e.g., local awareness (7), inter-departmental cooperation (5), stakeholder engagement (8), societal action (9), and strengthened municipal capacities for action (4)—in a ripple-like effect. Similarly, when climate policies are strategically framed as instruments for addressing shared community concerns—such as safety and disaster preparedness, welfare and quality of life,

economy and community revitalization, and other local topics—they elicit stronger support and willingness to cooperate from diverse municipal departments (Quadrant 5). Likewise, strategic messaging that underscores the local relevance of climate goals helps raise public awareness and climate consciousness (Quadrant 7), while also building consensus and partnerships with stakeholders (Quadrant 8).

From the perspective of senior levels of government (national and regional), locally grounded motivations also play a clarifying and enabling role. They can be incorporated into strategic visions of national and regional development, where local community and urban concerns are increasingly recognized as central components (Quadrant 1). As it becomes evident that funding allocated to municipalities can be used effectively and efficiently to advance both climate objectives and pressing societal goals—such as regional economic revitalization, disaster preparedness, welfare improvement, and energy security—supportive frameworks, coordination mechanisms, and funding systems at higher government levels can be strengthened accordingly (Quadrant 2) which in turn will make available resource for local needs (Quadrant 3) and channel them towards building local capacities (Quadrant 4).

In this way, motivations exert influence throughout the model—from strengthening political viability (the lower row of the matrix), to enhancing organizational consensus and coordination (the middle row), and through them, ultimately to enabling greater capacity flows toward municipalities (the top row). By embedding climate action within narratives of shared value and mutual benefit, motivations link local and national agendas, transforming fragmented initiatives into a coherent, multi-level effort toward net-zero.

7.3.3.2 Motivations as Providing Direction and Translating Potential into Action

While motivations help reinforce the enabling environment, their deeper significance lies in how they act as a conduit for translating municipal capacities into purposeful action and orienting local efforts toward achieving net-zero. This translational role turns the system from one that is merely *able to act* into one that both *can and wants to act*.

Scholars have long noticed that the lack of progress on climate policies cannot be solely explained by the lack of capacities alone, noting that “normative or motivational context” is no less “important than resource constraints” (Burch, 2010b), and although capacity factors are necessary, they “are not sufficient for policy to be implemented” (D. Ryan, 2015). The literature thus calls for closer attention to *agency* and *motivation* as integral dimensions of local governance (Domorenok et al., 2021; D. Ryan, 2015).

Through the synthesis described in Section 7.2.1 (Synthesizing Motivations), the numerous motivational themes that emerged from the municipalities’ open-ended survey responses were distilled into four motivational meta-themes. These meta-themes, empirically grounded in open-

ended responses from 153 municipalities, illustrate the collective logic of municipal reasoning about climate action. While each individual response reflected a particular local perspective, their synthesis revealed a deeper pattern—a shared progression in how municipalities commonly conceptualize their motivations. This progression comprises four stages, each representing a different level of realization (understanding/comprehension) through which municipalities discover their *agency and interest* in pursuing net-zero futures: from (I) recognizing the connection of climate action with addressing local issues, to (II) envisioning concrete projects that target those issues through climate measures, to (III) using synergetic climate–local issue plans as an instrument for consensus-building and collective action, and finally, to (IV) seeing climate action as a pathway toward a desirable and sustainable urban future to be passed on to future generations.

The first meta-theme represents the *recognition of the local relevance of climate action*. The main leitmotif here is that municipalities perceive climate action as closely related to major local challenges and concerns, such as economic decline, an aging society, depopulation, vulnerability to disasters, and other pressing issues. In addition, municipalities recognize that achieving net-zero cities is fundamentally aligned with their core responsibilities and mandates (i.e., their *raison d'être* as local governments), such as ensuring residents' safety, improving city services, and enhancing residents' welfare and livability. Climate action is hence seen not as contradictory to municipal conventional roles, but as part of them, and not as an “extra” issue, but simply as another angle on the same local issues, thus remaining a part of the municipality's core operations and its reason to exist (*raison d'être*).

The second meta-theme, which further advances the discovery of agency and self-interest of municipalities in pursuing net zero, illustrates how *many municipalities envision concrete climate projects and initiatives as instrumental in addressing local challenges*. For instance, promoting local production and local consumption of renewable energy, improving energy efficiency, jointly developing waste-to-energy facilities with neighboring municipalities, investing in sustainable transport, and urban greening, among many other initiatives, are all perceived as not only advancing cities' net-zero objective but also addressing local issues such as energy and fiscal autonomy, local socio-economic revitalization, disaster resilience, residents' health, quality of life and much more. In this way, municipalities adopt a pragmatic perspective, seeing climate action as a concrete and achievable pathway that can generate a wide range of tangible benefits for their communities.

The third meta-theme introduces the dimension of *cooperation and consensus-building*. Municipalities well recognize the limitations of siloed governmental action and the importance of engaging a wide range of actors in a shared effort. They begin to perceive the potential of using climate measures framed around common local benefits (e.g., economic opportunities, improved safety and autonomy, and greater local attractiveness) as *a platform for consensus-building and*

for rallying diverse stakeholders toward shared objectives. Emphasizing co-benefits and clear linkages to stakeholders' interests and residents' well-being becomes an effective way to raise awareness, foster broader policy buy-in, and encourage participation. Furthermore, municipal leadership in environmental policy further strengthens civic pride and the city's image (which, in turn, enhances local attractiveness and can spur revitalization by drawing new residents and investments). Likewise, improvements in local quality of life reinforce residents' satisfaction and attachment to place, creating a positive feedback loop of engagement and support. In this way, net zero becomes a rallying platform which builds stronger bottom-up ownership of the city's initiatives and policies, fosters cooperation across sectors, and stimulates independent voluntary action and initiatives (e.g., private-sector projects, residents' engagement in low-carbon lifestyles), thus ultimately bringing collective capacities together into a unified and more effective local climate action.

The fourth meta-theme embodies *vision and intergenerational continuity*. Here, municipalities perceive achieving *net zero as integral to creating a desirable and sustainable future that can be passed on to future generations*. Climate action is perceived as part of a broader strategic vision in which many local objectives—economic revitalization, environmental preservation, enhanced livability and welfare, and increased city attractiveness—are successfully addressed, while risks such as heat stress, disasters, and resource insecurity are mitigated. Many municipalities have already articulated such visions in their comprehensive city plans, often linking decarbonization to long-term mottos of building “healthy,” “vibrant,” or “purposeful” communities.¹⁹ Within this vision, climate policy is not only a developmental goal but also an act of intergenerational responsibility—a means of safeguarding the city's well-being so that it can be passed on in good condition to future residents.

Taken together, the four motivational meta-themes reveal the collective reasoning through which municipalities make sense of their agency and interest in pursuing net-zero. While each municipality may emphasize different aspects—some locating motivation in the relevance of climate to local issues, others in tangible projects, cooperation, or long-term vision—the meta-themes together form a coherent interpretive logic. Viewed in aggregate, they can be imagined as a progression of understanding: from recognizing relevance, to envisioning pathways, to building coalitions, and to projecting those efforts into the future.

This shared logic illustrates how motivations function as a translation and orientation mechanism within the heuristic: they translate existing local strengths, abilities, resources, and institutional arrangements into a clear drive to act, and they orient that drive toward a shared vision

¹⁹ For instance, one city designated itself as “Healthy and Happy City”, setting a vision for a “city where people can have a sense of purpose in life, be healthy and happy.” (see Table 5.3, motivation theme MT-14)

of sustainable, low-carbon, livable cities. Through this logic, municipalities come to see climate policy not as an external requirement but as an expression of their own self-interest and responsibility—something that serves local priorities today while shaping the community they wish to pass on to future generations. In this way, motivations help municipalities recognize their own agency in acting locally toward global mitigation goals, mobilize resources and collective action in alignment with local values, and move unitedly toward net-zero cities.

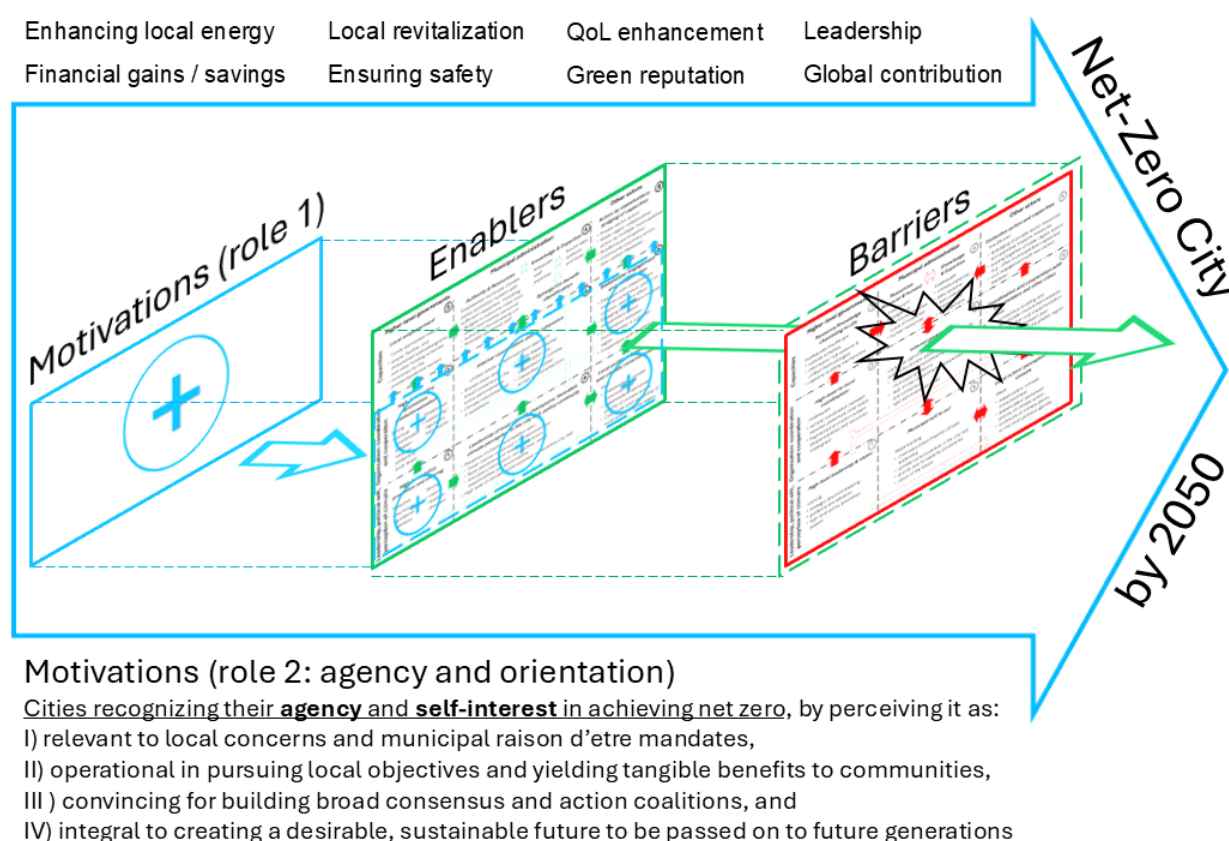
7.3.3.3 Completing the Picture

The discussion above has shown that motivations play a dual role in local climate governance—both reinforcing the enabling environment and translating capacities into purposeful action. With these two roles considered together, motivations complete the conceptual structure of the Integrated Heuristic. Figure 7.11 illustrates the complete framework, relating the Motivations dimension to the Barriers and Enablers matrices to show how the three components interact as a single meta-system.

As the figure shows, motivations bring a crucial dimension that animates the entire system. First, motivations can be strategically communicated—framing the co-benefits of action in locally relevant terms—to build support for climate initiatives among multiple actors. This helps to strengthen institutional settings, enhance organizational coherence, promote collaboration across governance levels, and improve overall policy cohesion. In doing so, motivations loosen the web of interlocking barriers that constrain municipal action and unlock stronger capacities for local climate policy. This establishes a stronger ability to act. Yet, to ensure that this ability is directed toward the net-zero goal—rather than dispersed across competing priorities—municipal actors must also find a clear stake and interest in climate action.

Such orientation emerges when actors recognize their agency and self-interest in taking action: they understand that they not only can act but also want to act (and will benefit from doing so). The perception of such agency is achieved by recognizing the relevance of climate policy to local challenges (and hence municipal core responsibilities), viewing climate action as instrumental in addressing these key local issues, and using it as a conducive avenue for rallying stakeholders and, ultimately, for shaping a desirable, sustainable future.

Figure 7.11. The Integrated Heuristic of Local Climate Governance (complete view)



Note: Motivations' role 1 refers to their ability to strengthen enablers and lower barriers (particularly strengthening the political and organizational dimensions, which in turn support stronger municipal capacity for action). Motivations' role 2 refers to their facilitating power in translating municipal capacity into goal-oriented (net-zero) action. Without the second orienting role, the capacities are unlikely to be channeled toward the net-zero goal and will likely be dispersed among competing priorities. The second role is manifested when the municipality recognizes the four major tenets of its agency and self-interest toward net-zero, namely: the local relevance of net-zero, its potential to address local issues, its potential for coalition-building, and its normative inter-generational importance for building a sustainable town's future. Source: Author.

In this way, motivations bridge capacity and purpose, providing the “normative and motivational context” (Burch, 2010b) and illuminates the role of “actor agency” (D. Ryan, 2015) that, as scholars have noted, previous climate governance frameworks have often lacked. As such, motivations bring forth the actor-oriented, agency-related dimension that transforms ability into ambition and ambition into directed collective action. With motivations, barriers, and enablers integrated into a single systemic structure, the IHM offers a coherent representation of how local climate governance operates as an interdependent, multi-level configuration rather than as a set of isolated factors.

Yet, as with any conceptual synthesis, the model inevitably reflects the empirical material and interpretive choices through which it was constructed. Before proceeding to broader concluding reflections, it is therefore important to clarify the boundaries and limitations inherent in the model itself.

7.3.4 Model Limitations and Applicability

The Integrated Heuristic Model of Local Climate Governance (IHM) represents a conceptual synthesis of multiple strands of evidence. Nevertheless, several limitations should be acknowledged at the level of the model itself.

First, while the analytical backbone of the IHM is grounded in a comprehensive review of international literature (i.e., the integrated analytical framework of MBEs introduced in Chapter 2), the empirical configuration of the model is primarily informed by data from Japanese municipalities. The thematic structures underlying the motivational meta-themes and the relational mapping of barriers and enablers were derived from survey responses and qualitative material collected within Japan. As such, the interpretive patterns embedded in the model inevitably reflect institutional and cultural characteristics of the Japanese governance context. Although the categories and dimensions of the framework draw on internationally recurring MBE factors, the relational architecture of the heuristic was refined through context-specific evidence.

Second, the meta-themes informing the IHM were constructed inductively from qualitative open-ended responses. Since the thematic analysis emphasized remaining as close as possible to the original meaning of respondents' statements during the synthesis process, contextual imprint is inherently present in the resulting themes, which in turn constitute the building blocks of the model. For instance, the progression identified in the motivational logic—from recognizing local relevance to envisioning pathways, building coalitions, and articulating long-term vision—represents an aggregated reasoning pattern observed within the Japanese dataset. Whether similar structures of reasoning would emerge in other political or administrative cultures remains an empirical question.

Third, the IHM is heuristic by design. It does not establish formally tested causal pathways, nor does it quantify the relative strength of interdependencies among governance dimensions. Instead, it visualizes empirically grounded associations and systemic linkages to support explanatory reasoning and practical reflection. In doing so, it necessarily simplifies complex governance realities and abstracts from contextual contingencies, actor-specific power dynamics, and institutional variation.

These limitations suggest that the IHM should be understood as a context-informed analytical framework rather than a universally generalizable governance model. For scholars, the model invites comparative application and empirical testing in different national and institutional settings to assess its robustness. For practitioners, it serves as a diagnostic and reflective tool—one that can be adapted to local conditions rather than implemented as a prescriptive blueprint.

Importantly, the model's contextual grounding does not negate its broader relevance. The initial framework that structured the survey instrument was derived from international scholarship,

providing conceptual guardrails extending beyond the Japanese case (as outlined in Chapter 2). The empirical findings refined and relationally configured this foundation, but did not replace it. The IHM therefore stands as a theoretically anchored and empirically informed contribution that remains open to contextual refinement and future validation.

7.4 Dissertation's Concluding Reflections

With this final conceptual synthesis, the dissertation is nearing its conclusion. In this thesis, I sought to unpack *the motives that drive municipalities towards achieving net-zero cities, the barriers that hold them back, and the enablers that help them move forward*. Furthermore, I sought to gain a holistic understanding of these issues, discovering their complex interrelated nature.

7.4.1 Revisiting the Research Problem

The literature offered many clues, but much of this knowledge was fragmented, with only a few studies systematically cataloguing multiple motivations, barriers, and enablers, yet failing to indicate their relative importance or how they interact and combine to shape local climate governance. Simply put, we knew “*what*” the factors were, but not “*to what extent*” and “*why they mattered*” to municipal practitioners, nor “*how they worked together*” to produce either progress or inertia. Without this understanding, everything seemed important, and hence by extension, nothing was genuinely important.

Such a state of knowledge impeded cities from building cohesive governance systems and planning effective policies that would ensure the most progress. What's more, the disparate factors were often treated as if they could be targeted individually through single-point solutions. For instance, with many studies reporting that municipalities lack sufficient resources, the impression was created that if only additional budgets were provided, most problems would be solved.

Yet, as existing research reveals, even progress by frontrunner and affluent, high-capacity cities has often fallen short of expectations (van der Heijden, 2019; van der Heijden et al., 2018, 2019). When examined more closely through case studies, the challenge has proven to extend well beyond funding gaps to include deeper institutional, organizational, and cultural-psychological-political issues that both underpin capacity constraints and prevent existing capacities from translating into sustained action (Burch, 2010a, 2010b; D. Ryan, 2015). Ensuring effective local climate governance has therefore proven to be a “wicked problem”—one that defies single-cause explanations and one-size-fits-all solutions, as the issues are deeply interwoven and require comprehensive, systemic approaches.

Therefore, I sought to address these puzzles by not only (1) identifying which motivation, barrier, and enabler factors (out of a myriad) matter the most to municipal practitioners, but also

(2) why they matter to them, and furthermore, (3) how they interplay and weave together to shape local climate governance in practice.

Understanding these relationships would advance the field by sharpening focus on the most salient governance factors, avoiding the “everything matters” trap, and by moving from simply *listing* factors toward *explaining* them. Moreover, this meant uncovering the *underlying conceptual structure of how these factors are interwoven and mutually reinforcing, rather than independent*. Such an understanding would help avoid single-pointed, overly simplistic interventions and instead open pathways for more comprehensive and effective strategies—strategically using both motivations and enablers to target interlocking barriers, break inertia, and achieve greater progress toward net-zero cities.

7.4.2 Summary of Approach and Key Contributions

To achieve this, I designed a mixed-method, comprehensive, integrative, and transdisciplinary inquiry. It began by building an Integrated Analytical Framework that organized the many motivations, barriers, and enablers (MBEs) found in the literature into a coherent structure (Tables 2.1-2.3 and Figure 2.1). This framework formed the basis for an ambitious nationwide survey of Japan’s 489 net-zero-committed municipalities. With responses received from 309 of them, it resulted in one of the most substantial datasets of its kind (see Table 7.1 for comparison with other large-n surveys).

The questionnaire combined different question types in a logical cognitive progression—from structured evaluations to single-item prioritizations and open-ended reflections—designed to sustain engagement while capturing both quantitative and qualitative insights. This approach made it possible to triangulate numerical evaluations with contextual reasoning, yielding a rich, multi-dimensional picture of how municipal officials perceive, prioritize, and explain the factors shaping their progress toward net zero.

The subsequent multiple analyses of the dataset clarified the questions above. First, quantitative analysis has revealed which particular motivations, barriers and enablers were perceived as most salient among a large number of Japanese municipalities (Chapter 4). Based on descriptive statistics, the findings provided a representative bird's-eye view of the top-ranked factors. This gave an overview picture of key factors, which, given the sample size, could be generalized across diverse municipal contexts. Additionally, a correlation analysis revealed numerous associations among various factors based on how respondents evaluated them.

The thematic analysis (Chapter 5) then moved beyond rankings, turning to a dataset of nearly one thousand open-ended responses, to examine the reasoning behind municipal responses, uncovering the shared narratives, interpretations, and contextual understandings behind the local movement toward net-zero cities. Such analysis provided unprecedented contextual depth for

large-n survey studies, achieving what is rarely achievable in a single study – bridging depth with generalizability. In essence, my survey instrument combined the structured precision of a questionnaire with the interpretive interview-like depth of textual responses. Furthermore, open-ended responses and their analysis provided a further empirical link to understanding the interconnections among factors, grounded in respondents' own reasoning.

Seeking to transcend academic boundaries and bring this research closer to the realities and actors on the ground, I engaged in a variety of transdisciplinary activities (Chapter 6). Early engagements—such as fieldwork through interviews and site visits in several Japanese cities, as well as an internship at an environmental policy research institute—helped anchor the study in lived realities and directly informed the design of the survey. Later activities included organizing an international multi-stakeholder forum on Zero-Carbon Cities, which served as a platform for municipal officials, researchers, students, and civil society actors to exchange perspectives and provide feedback on preliminary survey findings. Other action-oriented initiatives, including public workshops, youth-focused awareness programs, and other outreach events, further extended the research into the public sphere. Finally, self-reflective work on my own research journey within the context of transdisciplinary inquiry resulted in the creation of a framework that operationalizes transdisciplinary theory, particularly suited for graduate education. Through all these activities, I sought to engage with diverse society actors and co-produce knowledge towards both ends: to enrich the present research and make a tangible impact not only as a researcher, but also as a citizen.

Finally, this dissertation culminated in bringing all strands of evidence together into a final conceptual synthesis—the Integrated Heuristic Model of Local Climate Governance (IHM). Drawing on the themes that emerged from the qualitative analysis (Chapter 5), the key factors identified and ranked in the quantitative findings (Chapter 4), the observed correlations among barriers (Chapter 4), the open-ended survey responses, insights from transdisciplinary engagements (Chapter 6), and the existing literature, the final synthesis took shape inductively—from empirical evidence toward conceptual understanding. The resulting model serves as both a theoretical contribution and a practical tool (hence the term *heuristic*), illustrating how motivations, barriers, and enablers interact dynamically across actors, governance levels, and institutional functions. The heuristic reframes local climate governance as a system of feedbacks—where deficiencies in one area can constrain others, but where strategic reinforcement can also trigger virtuous cycles of progress. Each municipality, according to its context, can use the framework to target its salient barriers through multiple complementary channels of enablers that can be strategically strengthened to weaken those barriers.

Importantly, the integration of motivations (e.g., local revitalization, safety, livability, reputation) introduces agency and purpose into this system. It demonstrates how clarifying and

strategically communicating compelling reasons to act can reinforce enablers while simultaneously directing existing capacities toward achieving net-zero outcomes. This process occurs as municipalities come to realize four key points that define their agency and self-interest in pursuing climate action: (1) its relevance to diverse local concerns and core municipal responsibilities; (2) its instrumental role as a practical pathway to address local issues; (3) its coalition-building and consensus-forming potential; and (4) its integral role in shaping a desirable, sustainable future to be passed on to future generations. These four points emerged as meta-themes from the final synthesis of motivational themes (i.e., those that emerged from thematic analysis described in Chapter 5), revealing a shared reasoning pattern through which municipalities make sense of their actions toward net-zero cities and transforming many fragmented reflections into a single, integrated logic of motivation and purpose.

7.4.3 Practical and Theoretical Implications

Through the above contributions, this dissertation has answered what motivations, barriers, and enablers matter most for municipalities in their progress toward net-zero cities, why they matter for municipalities in shaping governance outcomes, and how these factors interrelate to form a coherent system. The quantitative analysis identified the most salient factors and their associations; the qualitative analysis revealed how municipal officials interpret and rationalize them; the transdisciplinary engagements triangulated these findings through lived experiences and collective reflection; and the final synthesis consolidated these insights into a practical, conceptual tool. Together, these components provide not only answers to the research questions but also a comprehensive perspective on the mechanisms that underpin local climate governance.

Practically, the Integrated Heuristic Model of Local Climate Governance (IHM) offers municipalities a usable framework for diagnosing and improving their governance systems. It allows municipal actors to visualize how barriers are interconnected and to identify multiple enabling pathways through which these barriers can be strategically addressed. Rather than prescribing fixed policy recommendations, the heuristic enables each municipality to use its own context as the starting point for designing targeted interventions. As shown in Section 7.3.2, enablers—such as leadership, institutional coordination, or stakeholder collaboration—can be strengthened along several complementary channels to unlock capacity and overcome inertia. The model also underscores the central role of motivations: by linking climate action to locally meaningful narratives of safety, prosperity, and quality of life, municipal leaders can strengthen political will, foster cooperation, and sustain momentum and orientation of efforts toward achieving sustainable net-zero urban futures. In this way, the heuristic serves as both a diagnostic and strategic tool, helping municipalities not only to assess their current challenges but to plan actionable, context-sensitive pathways toward net-zero transitions.

Theoretically, the study contributes to advancing the understanding of local climate governance as a system of interdependent dynamics rather than a collection of isolated factors. The Integrated Heuristic responds to long-standing calls in the literature to move beyond static typologies toward a more integrated and configurational perspective. It builds directly on calls to explore the “dynamic interactions” among categories of barriers and enablers (Burch, 2010b), and to develop a “configurational approach” that identifies “different and alternative combinations of conditions” through which local policy success emerges (D. Ryan, 2015). The heuristic developed here answers these calls by depicting how motivations, barriers, and enablers influencing local climate governance are embedded within a web of multi-actor relationships among levels of capacity, coordination, and political will.

This model thereby answers the gap highlighted across several strands of literature: that barriers and enablers are deeply interwoven phenomena (Burch, 2010), that single interventions often fail when reinforcing barriers remain unaddressed (Biesbroek et al., 2013; Moser et al., 2019), and that transitions “rarely depend on any single factor” but instead unfold through multi-level, multi-actor interaction (Lwasa et al., 2022). By mapping these interrelations empirically and conceptually, this research moves beyond linear explanations and shows that the success of local climate governance depends on alignment—the alignment of capacity, coordination, and motivation across actors and governance scales.

Empirically, this study contributes one of the largest and most comprehensive datasets on municipal motivations, barriers, and enablers for net-zero action, identifying what truly matters to practitioners and explaining why. The quantitative ranking of factors directly responds to calls in the literature for “a systematic and integrated assessment of key barriers and enablers” (Steg et al., 2022), thus addressing the so-called “everything matters trap” (D. Ryan, 2015) by distinguishing the relatively most critical governance factors. The qualitative themes ground them in the reasoning of municipal officials themselves, thus responding to calls in literature to move “beyond describing and enumerating barriers toward explaining them” (Eisenack et al., 2014), i.e., explaining why the factors actually matter to municipal practitioners. Both the rankings and the qualitative themes presented here can inform scholars and practitioners seeking to design interventions or comparative studies, and the heuristic offers a framework for applying these insights to practice.

Methodologically, this dissertation demonstrates how mixed-method and transdisciplinary designs can effectively bridge scale and depth in survey-based research. It shows that large-n questionnaires can capture not only quantitative patterns but also in-depth place-based reasoning and the context behind them, when complemented by open-ended questions and qualitative analysis, thus revealing deeper shared patterns at scale and enabling theory-building. The transdisciplinary component further extended this integration, demonstrating how academic research can evolve into a co-creative process that enriches understanding while generating societal value. Lastly, the

thesis exemplifies how usable analytical frameworks can be developed inductively from rich empirical evidence collected through thoroughly designed survey instruments and multiple iterations of integrative analyses.

7.4.4 Transferability of the Findings Beyond the Japanese Context

Having discussed the study's implications, it is necessary to address the broader question raised by this dissertation: to what extent can findings derived from the Japanese case inform understanding of local climate governance elsewhere?

The empirical results demonstrate both convergence with international patterns and context-specific emphases. As discussed in Sections 4.3.3 and 7.1.1, many of the highest-ranked barriers and enablers in Japan—particularly financial constraints, limited staff capacity, and the importance of organizational coherence—closely mirror findings from survey-based studies in North America and Europe (Aylett, 2014; Rhodes et al., 2021; Salon et al., 2014). Similarly, the prominence of economic co-benefits as key motivations aligns with prior research emphasizing cost savings, local development, and tangible local gains as durable drivers of municipal climate action (Krause, 2013; Salon et al., 2014). In this respect, the Japanese results reinforce rather than contradict international empirical trends.

Where Japanese specificity becomes analytically meaningful is in the intensity and framing of these motivations. The Japanese municipalities surveyed in this study consistently embedded climate action within narratives of economic revitalization, demographic stabilization, energy autonomy, and disaster resilience (Chapters 4 and 5). These priorities reflect structural conditions that are especially salient in Japan: prolonged economic stagnation, population aging, rural depopulation, fiscal pressures on local governments, and high exposure to natural hazards (JICA, 2017; NEASPEC, 2021; UNCRD, 2014). In this context, climate governance is framed less as symbolic leadership or global moral positioning and more as a pragmatic instrument for sustaining local viability and safeguarding communities.

However, such pragmatism should not be interpreted as uniquely Japanese. Municipalities in many countries confront analogous structural pressures, albeit in different combinations and intensities. Cities undergoing economic transition, fiscal stress, or climate vulnerability may exhibit motivational patterns similar to those observed in Japan. Conversely, municipalities embedded in highly politicized climate debates or advocacy-oriented networks may elevate symbolic or ideological motivations more strongly (Aylett, 2014; Krause, 2013). Thus, what varies across contexts is less the existence of particular MBE categories and more their relative salience within specific socio-political environments.

At a deeper level, the transferability of this dissertation lies not only in individual factor rankings but in the systemic logic articulated through the Integrated Heuristic Model (IHM). The

model's central insight—that motivations, barriers, and enablers operate through interdependent feedback loops across governance levels and actor groups—is consistent with widely documented characteristics of multi-level climate governance (Burch, 2010b; Eisenack et al., 2014; Lwasa et al., 2022). Fragmented authority, capacity constraints, and the need for coordination and political prioritization are recurrent themes in international governance scholarship. The bridging role of motivations in translating institutional capacity into purposeful action likewise echoes arguments that agency and framing are essential complements to capacity (Burch, 2010b; D. Ryan, 2015).

Importantly, the IHM was designed as a configurational framework. It does not prescribe a fixed sequence of interventions nor assume that specific barriers must dominate across all contexts. Instead, it allows different governance configurations to be diagnosed and addressed depending on local conditions. This flexibility strengthens its applicability: the model can be used to analyze diverse municipal systems without assuming replication of Japan's empirical hierarchy of factors.

Finally, it must be recognized that the IHM represents an interpretive theoretical synthesis. In moving from empirical observations to a systemic model, inductive abstraction was necessary. The model therefore approximates governance dynamics rather than asserting universally validated causal laws. Its broader applicability depends on comparative testing and contextual refinement in other national and municipal settings.

In sum, the Japanese case provides one empirically grounded configuration of local climate governance under conditions of economic strain, demographic transition, and environmental vulnerability. While the specific prioritization of motivations may reflect these contextual pressures, the underlying categories, interdependencies, and agency-centered dynamics identified in this dissertation offer a conceptual lens that is transferable beyond Japan. The contribution of this research lies not in replicating Japan-specific rankings, but in identifying governance factors that are recurrently salient across contexts and in articulating systemic patterns that can be applied, adapted, and further developed within diverse governance environments.

7.4.5 Overall Limitations

The limitations of each major analysis and its methods have been discussed in their respective chapters (Chapters 4–7). In brief, the survey-related limitations (see Chapters 4 and 5) concern its sample scope—focusing exclusively on net-zero-committed municipalities while excluding non-committed and prefectural governments—and its reliance on municipal officials (primarily from environmental or climate departments) as respondents representing their administrations. Methodologically, the survey depended largely on perception-based data, with limited integration of objective indicators (e.g., socio-demographic or economic variables) that would allow systematic comparison across different types of municipalities. It also did not explore how existing local

climate policies may have shaped respondents' perceptions, nor did it include follow-up interviews to further validate or deepen interpretations of the open-ended responses.

Regarding the transdisciplinary activities (Chapter 6), while these engagements enhanced the societal grounding of the research, they were limited in scope and scale and cannot be considered representative of all stakeholder perspectives. Moreover, the participatory nature of these activities inherently involves a degree of interpretive positioning by the researcher.

Concerning the final synthesis presented in Chapter 7, and in addition to the model-level limitations discussed in Section 7.3.4, the Integrated Heuristic Model of Local Climate Governance necessarily simplifies a highly complex governance reality. Although the heuristic incorporates a multi-actor dimension, it remains fundamentally municipality-centric, reflecting the perceptions of municipal officials who formed the study's core respondents. As a result, it explains governance dynamics primarily from the local government perspective rather than equally from the viewpoints of civil society, business actors, or higher tiers of government. While this municipal focus was an intentional feature of the actor-oriented design, engagement with other actors' perspectives was limited mainly to the transdisciplinary components described in Chapter 6.

Finally, at the level of the overall dissertation, the study is primarily explanatory rather than evaluative. It seeks to clarify how municipalities understand and navigate net-zero governance rather than to measure the effectiveness of their actions in achieving emissions reductions or policy outcomes. Future research may extend this work by applying and testing the heuristic model in other national and regional contexts, incorporating a broader range of actor perspectives, and integrating outcome-oriented indicators to assess how governance configurations translate into measurable climate progress.

7.4.6 Concluding Takeaways

This dissertation sought to clarify the key motivations driving municipalities toward achieving net zero, as well as the factors that hinder or facilitate their progress. The central question, while simple, stemmed from a complex reality: if most cities acknowledge the urgency of climate action (as is the case in Japan, where a majority of municipalities have made net-zero commitments), what considerations actually drive them, and why do so many still struggle to deliver progress, and how can it be accelerated? Through the empirical and conceptual work presented here, the answer emerged not as a single explanation, but as a set of interconnected insights.

Municipalities are motivated by a variety of factors that reflect both local concerns and future aspirations. As the survey revealed, motivations such as local economic development, safety, and quality of life consistently ranked highest, reflecting a broader pattern of interpreting climate action through the lens of local relevance and benefit. The synthesis of municipal officials' own explanations uncovered a deeper logic: climate action becomes particularly meaningful and

actionable when it is perceived as locally relevant and instrumental to fulfilling the municipality's core mandates and long-term goals.

At the same time, municipalities face persistent constraints—from insufficient budgets and staffing to weak organizational coherence and inconsistent leadership. More importantly, these barriers are interconnected: they reinforce one another, forming negative feedback loops that lock local governments into inaction inertia. Breaking this gridlock requires activating and combining various enablers, many of which mirror the barriers themselves (for example, adequate budgets, improved internal coordination, or engaged leadership). These enablers can be strategically mobilized across multiple pathways—by pooling departmental capacities, engaging external stakeholders, or leveraging support from higher levels of government.

This dynamic was captured in the Integrated Heuristic Model of Local Climate Governance (IHM), developed as the culmination of this dissertation. Emerging from multiple strands of empirical evidence and conceptual synthesis, the heuristic offers both an analytical and practical lens—a simplified model that helps policymakers, researchers, and practitioners to navigate and make sense of the complex governance landscape. It serves as a tool for identifying how barriers interlock, where enabling forces can be strategically strengthened to reinforce one another, and what motivations can be utilized to enable more substantial progress. Taken together, the findings of this research show that local climate action is not simply a question of having the capacity to act, but of aligning the capacities of multiple actors, building conducive organizational structures, and leveraging compelling motivations, all of which make progress possible. Progress occurs when actors' capabilities, institutional coherence, and willingness to act with a shared sense of purpose reinforce one another. When these dimensions operate in isolation, efforts stall, but when they connect, momentum toward net-zero goals builds.

The broader message of this dissertation is that the path to net-zero cities begins not with external mandates or technical blueprints, but with clarity of purpose (*why move toward it?*) and coherence of effort (*are actors moving together in a coherent and unified fashion?*). The dissertations showed that municipalities advance when their political, organizational, and social systems align around a vision that is both aspirational and locally grounded. When climate action is embedded in the same narratives that guide local development—economic renewal, safety, livability, and community identity—it ceases to compete with other priorities and, instead, becomes a vehicle for achieving multiple goals. Strong motivations, once internalized, reinforce enablers and weaken barriers, unlock greater capacities, and orient actors toward unified action. In the alignment of a shared purpose, coherent institutional structures, and enhanced capacities lies the foundation for genuine progress toward net-zero cities.

References

- 2030 SDGs GAME. (2018, August 17). 2030sdgsgame official; 2030sdgsgame.
<https://2030sdgsgame.com/2030-sdgs-game/>
- Acuto, M. (2013). The new climate leaders? *Review of International Studies*, 39(4), 835–857.
<https://doi.org/10.1017/s0260210512000502>
- Anguelovski, I., & Carmin, J. (2011). Something borrowed, everything new: innovation and institutionalization in urban climate governance. *Current Opinion in Environmental Sustainability*, 3(3), 169–175. <https://doi.org/10.1016/j.cosust.2010.12.017>
- Arroyo, V. (2019). From Paris to Pittsburgh: U.s. state and local leadership in an era of trump. *The Georgetown Env'tl. Law Review*, 31, 433–454.
<https://www.law.georgetown.edu/environmental-law-review/wp-content/uploads/sites/18/2019/05/GT-GELR190015.pdf#:~:text=in>
- Aylett, A. (2010). Municipal bureaucracies and integrated urban transitions to a low carbon future. In Bulkeley H, Castán Broto V, Hodson M, Marvin S (Ed.), *Cities and low carbon transitions* (pp. 142–158). Routledge.
- Aylett, A. (2014). *Progress and challenges in the urban governance of climate change: Results of a global survey*. MIT Press. <https://espace.inrs.ca/id/eprint/2835/1/Aylett-2014-Progress>
- Aylett, A. (2015). Relational agency and the local governance of climate change: International trends and an American exemplar. In C. Johnson, N. Toly, & H. Schroeder (Eds.), *The urban climate challenge: Rethinking the role of cities in the global climate regime* (pp. 156–179). Routledge.
https://www.researchgate.net/publication/281441876_The_Urban_Climate_Challenge
- Bai, X. (2007). Integrating global environmental concerns into urban management: The scale and readiness arguments. *Journal of Industrial Ecology*, 11(2), 15–29.
<https://doi.org/10.1162/jie.2007.1202>
- Bai, X. (2023). Make the upcoming IPCC Cities Special Report count. *Science (New York, N.Y.)*, 382(6670), ead1522. <https://doi.org/10.1126/science.adl1522>
- Bain, P. G., Milfont, T. L., Kashima, Y., Bilewicz, M., Doron, G., Garðarsdóttir, R. B., Gouveia, V. V., Guan, Y., Johansson, L.-O., Pasquali, C., Corral-Verdugo, V., Aragonés, J. I., Utsugi, A., Demarque, C., Otto, S., Park, J., Soland, M., Steg, L., González, R., ... Saviolidis, N. M. (2016). Co-benefits of addressing climate change can motivate action around the world. *Nature Climate Change*, 6(2), 154–157.
<https://doi.org/10.1038/nclimate2814>
- Beck, U., & Sznaider, N. (2006). Unpacking cosmopolitanism for the social sciences: a research agenda. *The British Journal of Sociology*, 57(1), 1–23. <https://doi.org/10.1111/j.1468-4446.2006.00091.x>
- Betsill, M., & Bulkeley, H. (2007). Looking back and thinking ahead: A decade of cities and climate change research. *Local Environment*, 12(5), 447–456.
<https://doi.org/10.1080/13549830701659683>
- Betsill, M. M. (2001). Mitigating Climate Change in US Cities: Opportunities and obstacles. *Local Environment*, 6(4), 393–406. <https://doi.org/10.1080/13549830120091699>

- Biesbroek, G. R., Klostermann, J. E. M., Termeer, C. J. A. M., & Kabat, P. (2013). On the nature of barriers to climate change adaptation. *Regional Environmental Change*, 13(5), 1119–1129. <https://doi.org/10.1007/s10113-013-0421-y>
- Biggeri, M. (2021). Editorial: A “Decade for Action” on SDG Localisation. *Journal of Human Development and Capabilities*, 22(4), 706–712. <https://doi.org/10.1080/19452829.2021.1986809>
- Blok, A. (2016). Urban Climate Risk Communities: East Asian World Cities as Cosmopolitan Spaces of Collective Action? *Theory, Culture & Society*, 33(7–8), 271–279. <https://doi.org/10.1177/0263276416669411>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Buchanan, J. M., & Tullock, G. (1962). *The calculus of consent: Logical foundations of constitutional democracy*. University of Michigan Press. <https://doi.org/10.3998/mpub.7687>
- Bulkeley, H. (2010). Cities and the Governing of Climate Change. *Annual Review of Environment and Resources*, 35(1), 229–253. <https://doi.org/10.1146/annurev-environ-072809-101747>
- Bulkeley, H. (2011). Cities and Subnational Governments. In J. S. Dryzek, R. B. Norgaard, & D. Schlosberg (Eds.), *The Oxford Handbook of Climate Change and Society* (pp. 464–478). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199566600.003.0031>
- Bulkeley, H., & Betsill, M. M. (2013). Revisiting the urban politics of climate change. *Environmental Politics*, 22(1), 136–154. <https://doi.org/10.1080/09644016.2013.755797>
- Bulkeley, H., Schroeder, H., Janda, K., Zhao, J., Armstrong, A., Chu, S. Y., & Ghosh, S. (2009). *Cities and Climate Change - The role of institutions, governance and urban planning*. Report prepared for the World Bank Urban Symposium on Climate Change. <https://www.researchgate.net/publication/254888120>
- Bunsell, P., Cooper, A., UNESCAP, & UN-Habitat. (2023). *The Future of Asian and Pacific Cities 2023 : Crisis Resilient Urban Futures*. ESCAP. <https://hdl.handle.net/20.500.12870/6370>
- Burch, S. (2009). *Local responses to climate change : an exploration of the relationship between capacity and action*. <https://doi.org/10.14288/1.0067519>
- Burch, S. (2010a). Transforming barriers into enablers of action on climate change: Insights from three municipal case studies in British Columbia, Canada. *Global Environmental Change: Human and Policy Dimensions*, 20(2), 287–297. <https://doi.org/10.1016/j.gloenvcha.2009.11.009>
- Burch, S. (2010b). In pursuit of resilient, low carbon communities: An examination of barriers to action in three Canadian cities. *Energy Policy*, 38(12), 7575–7585. <https://doi.org/10.1016/j.enpol.2009.06.070>
- Castán Broto, V., & Bulkeley, H. (2013). A survey of urban climate change experiments in 100 cities. *Global Environmental Change: Human and Policy Dimensions*, 23(1), 92–102. <https://doi.org/10.1016/j.gloenvcha.2012.07.005>
- CDP, & ICLEI. (2021). *Working Together to Beat the Climate Crisis: Collaborative City, State and Regional Climate Action – Six Country Snapshots*. CDP Worldwide.

- Cedamia. (2025). Cedamia | Climate Emergency Declaration & Mobilisation In Action; cedamia. <https://www.cedamia.org/global/>
- Charles, A. (2016, November 22). *The New Urban Agenda has been formally adopted. So what happens next?* World Economic Forum. <https://www.weforum.org/stories/2016/11/last-month-a-new-global-agreement-to-drive-sustainable-urban-development-was-reached-so-what-is-it-and-happens-next>.
- Citizens Assembly Japan. (2021, August 15). *Climate Assembly Sapporo 2020: Japan's first citizens' assembly on climate change*. citizensassembly.jp. https://citizensassembly.jp/project/ca_kaken/en
- Climate Action Tracker. (n.d.). Climate Action Tracker. Retrieved December 16, 2025, from <https://climateactiontracker.org/>
- Climate Assembly UK. (n.d.). *The Path to Net Zero*. Retrieved March 11, 2025, from <https://www.climateassembly.uk>
- Climate Mayors. (2025a, January 20). *STATEMENT: Climate Mayors to Uphold Paris Agreement Commitment and Accelerate U.S. Subnational Climate Ambition and Global Economic Competitiveness*. Climate Mayors. <https://www.climatemayors.org/post/paris-agreement>
- Climate Mayors. (2025b, March 19). *PRESS RELEASE: Mayors Highlight Programs in their Cities that Lower Costs, Boost Local Economies, and Fight Climate Change*. Climate Mayors. <https://www.climatemayors.org/post/climate-action-improves-public-safety-p2dw3>
- Climate Mayors. (2025c, April 10). *Statement: Climate Mayors Chair Mayor Kate Gallego Responds to White House Attempt to Hamper Local Climate Action*. Climate Mayors. <https://www.climatemayors.org/post/statement-white-house-attempt-to-hamper-local-climate-action>
- climateemergencydeclaration.org. (2025, March 24). *Climate emergency declarations in 2,366 jurisdictions and local governments cover 1 billion citizens*. Climate Emergency Declaration. <https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/>
- Conklin, J., Basadur, M., & VanPatter, G. K. (2007). Rethinking wicked problems—Unpacking paradigms, bridging universes. *NexD Journal*, 10(1). https://scholar.google.com/citations?view_op=view_citation&hl=en&citation_for_view=f14fkRoAAAAJ:35N4QoGY0k4C
- Coulombe, C., Maya-Drysdale, D., & McCormick, K. (2022). Local municipalities and the influence of national networks on city climate governance: Small places with big possibilities. *Frontiers in Sustainable Cities*, 4. <https://doi.org/10.3389/frsc.2022.970968>
- Davidson, K., Briggs, J., Nolan, E., Bush, J., Håkansson, I., & Moloney, S. (2020). The making of a climate emergency response: Examining the attributes of climate emergency plans. *Urban Climate*, 33, 100666. <https://doi.org/10.1016/j.uclim.2020.100666>
- De Gregorio Hurtado, S., Olazabal, M., Salvia, M., Pietrapertosa, F., Olazabal, E., Geneletti, D., D'Alonzo, V., Di Leo, S., & Reckien, D. (2015). Understanding how and why cities engage with climate policy: An analysis of local climate action in Spain and Italy. *Tema. Journal of Land Use, Mobility and Environment*, 8(SpecialECCA 2015), 23–46. <https://doi.org/10.6092/1970-9870/3649>

- Denhardt, R. B., & Denhardt, J. V. (2000). The New Public Service: Serving rather than steering. *Public Administration Review*, 60(6), 549–559. <https://doi.org/10.1111/0033-3352.00117>
- Denton, F., Halsnæs, K., Akimoto, K., Burch, S., Morejon, C. D., Farias, F., Jupesta, J., Shareef, A., Petra Schweizer-Ries, Teng, F., & Zusman, E. (2022). Accelerating the transition in the context of sustainable development. In P. R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. Van Diemen, D. McCollum, M. Pathak, S. Shreya, V. Purvi, F. Roger, B. Malek, H. Apoorva, L. Géninha, L. Sigourney, & M. Juliette (Eds.), *Climate change 2022: Mitigation of climate change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1727–1790). Cambridge University Press. <https://doi.org/10.1017/9781009157926.019>
- Deroche, M.-H. (2021). Ikikata toshiteno Tetsugaku-“Mon Shi Shū” no Igi to Kanousei 生き方としての哲学-「聞・思・修」の意義と可能性 [Philosophy as a Way of Life: Significance and Potentialities of “Listening, Reflection, and Practice. In 実践する総合生存学 [Human Survivability Studies in Practice (pp. 207–234). Kyoto University Press.
- Domorenok, E., Graziano, P., & Polverari, L. (2021). Introduction: policy integration and institutional capacity: theoretical, conceptual and empirical challenges. *Policy & Society*, 40(1), 1–18. <https://doi.org/10.1080/14494035.2021.1902058>
- Dubash, N., Mitchell, C., Lerum, E., Borbor-Córdova, M., Fifita, S., Haïtes, E., Jaccard, M., Jotzo, F., Naidoo, S., Romero-Lankao, P., Shen, W., Shlapak, M., & Wu, L. (2022). National and Sub-National Policies and Institutions. In P. R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. Van Diemen, D. McCollum, M. Pathak, S. Shreya, V. Purvi, F. Roger, B. Malek, H. Apoorva, L. Géninha, L. Sigourney, & M. Juliette (Eds.), *Climate change 2022: Mitigation of climate change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1355–1450). Cambridge University Press. <https://doi.org/10.1017/9781009157926.015>
- Eisenack, K., Moser, S. C., Hoffmann, E., Klein, R. J. T., Oberlack, C., Pechan, A., Rotter, M., & Termeer, C. J. A. M. (2014). Explaining and overcoming barriers to climate change adaptation. *Nature Climate Change*, 4(10), 867–872. <https://doi.org/10.1038/nclimate2350>
- Engel, K. H. (2006). State and Local Climate Change Initiatives: What is Motivating State and Local Governments to Address a Global Problem and What Does this Say About Federalism and Environmental Law? *The Urban Lawyer*, 38(4), 1015–1029. <https://www.jstor.org/stable/27895677>
- Engel, K. H., & Orbach, B. (2008). Micro-Motives for State and Local Climate Change Initiatives. *Harvard Law & Policy Review*, 2, 119–137. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1014749
- ESCAP/NEASPEC. (2021). *Comparative Study on Low Carbon City Development in China, Japan, and the Republic of Korea*. https://www.neaspec.org/sites/default/files/Compartive_Study_On_LCC-final.pdf
- Floater, G., Heeckt, C., Ulterino, M., Mackie, L., Rode, P., Bhardwaj, A., Carvalho, M., Gill, D., Bailey, T., & Huxley, R. (2016). *Co-benefits of urban climate action: a framework for cities. A working paper by the Economics of Green Cities Programme, LSE Cities, London School of Economics and Political Science* [A working paper by the Economics of Green Cities Programme, LSE Cities, London School of Economics and Political Science]. LSE Cities and C40 Cities Climate Leadership Group.

- Fuhr, H., Hickmann, T., & Kern, K. (2018). The role of cities in multi-level climate governance: local climate policies and the 1.5°C target. *Current Opinion in Environmental Sustainability*, 30, 1–6. <https://doi.org/10.1016/j.cosust.2017.10.006>
- Göpfert, C., Wamsler, C., & Lang, W. (2019). Institutionalizing climate change mitigation and adaptation through city advisory committees: Lessons learned and policy futures. *City and Environment Interactions*, 1(100004), 100004. <https://doi.org/10.1016/j.cacint.2019.100004>
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 105–117). Sage Publications, Inc., Thousand Oaks.
- Gudde, P., Oakes, J., Cochrane, P., Caldwell, N., & Bury, N. (2021). The role of UK local government in delivering on net zero carbon commitments: You’ve declared a Climate Emergency, so what’s the plan? *Energy Policy*, 154, 112245. <https://doi.org/10.1016/j.enpol.2021.112245>
- Hart, P. S., & Feldman, L. (2021). The benefit of focusing on air pollution instead of climate change: How discussing power plant emissions in the context of air pollution, rather than climate change, influences perceived benefits, costs, and political action for policies to limit emissions. *Science Communication*, 43(2), 199–224. <https://doi.org/10.1177/1075547020980443>
- Hsu, A., Weinfurter, A. J., & Xu, K. (2017). Aligning subnational climate actions for the new post-Paris climate regime. *Climatic Change*, 142(3–4), 419–432. <https://doi.org/10.1007/s10584-017-1957-5>
- ICLEI Network, Park, Y., Seo, E., & Kang, J. (2020, November 19). *The crucial role of local governments in South Korea’s bold actions towards carbon neutrality by 2050*. <https://talkofthecities.iclei.org/the-crucial-role-of-local-governments-in-south-koreas-bold-actions-towards-carbon-neutrality-by-2050/>
- IGES. (n.d.). *Kitakyushu Urban Centre*. Retrieved September 26, 2025, from <https://www.iges.or.jp/en/about/research-units/kitakyushu-urban-centre>
- International Labour Organization (ILO). (2015). *Guidelines for a just transition towards environmentally sustainable economies and societies for all*. ILO.
- IPCC. (2022a). Annex I: Glossary. In van Diemen, R., J.B.R. Matthews, V. Möller, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, A. Reisinger, S. Semenov (eds) (Ed.), *Climate Change 2022 - Mitigation of Climate Change* (pp. 1793–1820). Cambridge University Press. <https://doi.org/10.1017/9781009157926.020>
- IPCC. (2022b). Summary for Policymakers. In *Climate Change 2022 - Mitigation of Climate Change* (pp. 3–48). Cambridge University Press. <https://doi.org/10.1017/9781009157926.001>

- IPCC. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [core writing team, H. lee and J. romero (eds.)]. IPCC, Geneva, Switzerland (P. Arias, M. Bustamante, I. Elgizouli, G. Flato, M. Howden, C. Méndez-Vallejo, J. J. Pereira, R. Pichs-Madruga, S. K. Rose, Y. Saheb, R. Sánchez Rodríguez, D. Ürge-Vorsatz, C. Xiao, N. Yassaa, J. Romero, J. Kim, E. F. Haites, Y. Jung, R. Stavins, ... C. Péan, Eds.). Intergovernmental Panel on Climate Change (IPCC). <https://doi.org/10.59327/ipcc/ar6-9789291691647>
- Irvin, R. A., & Stansbury, J. (2004). Citizen participation in decision making: Is it worth the effort? *Public Administration Review*, 64(1), 55–65. <https://doi.org/10.1111/j.1540-6210.2004.00346.x>
- Jaglom, W., Frisch, C., Kennedy, K., Clarke, L., Hultman, N., Cyrs, T., Lund, J., Saha, D., Feldmann, J., Bowman, C., O'Neill, J., Campton, M., Herbert, M., Calle, L., Light, A., & Bodnar, P. (2020). *Delivering on America's pledge: Achieving climate progress in 2020*. Bloomberg Philanthropies with Rocky Mountain Institute, University of Maryland Center for Global Sustainability, and World Resources Institute. <https://cgs.umd.edu/research-impact/publications/delivering-americas-pledge-achieving-climate-progress-2020>
- JICA. (2017). *Handbook for Utilization of Regional Revitalization Resources. For regional management in developing countries*. Japan International Cooperation Agency.
- Jones, S. (2017). *Cities Responding to Climate Change: Copenhagen, Stockholm and Tokyo*. Springer Nature. <https://doi.org/10.1007/978-3-319-64810-1>
- Jordan, A., Huitema, D., Schoenefeld, J., van Asselt, H., & Forster, J. (2018). Setting the Scene. In A. Jordan, D. Huitema, H. van Asselt, & J. Forster (Eds.), *Governing Climate Change: Polycentricity in Action?* Cambridge University Press. <https://doi.org/10.1017/9781108284646>
- Joss, S. (2015). *Sustainable Cities: Governing for Urban Innovation* (2015th ed.) [PDF]. Red Globe Press.
- Kameyama, Y. (2016). *Climate Change Policy in Japan: From the 1980s to 2015*. Routledge.
- Kawai, S., & Oshima, K. (2018). Introduction. In S. Kawai, M. Fujita, & E. Kawai (Eds.), *Human Survivability Studies: New Paradigm Solving Global Issues*. Kyoto University Press.
- Kern, K., & Alber, G. (2009). Governing climate change in cities: Modes of urban climate governance in multi-level systems. In *The international conference on Competitive Cities and Climate Change, Milan, Italy* (pp. 171–196). OECD.
- Kingdon, J. W. (2013). *Agendas, alternatives, and public policies* (Updated edition). Pearson Education.
- Klein, R. J. T., Midgley, G. F., Preston, B. L., Alam, M., Berkhout, F. G. H., Dow, K., & Rebecca Shaw, M. (2014). Adaptation opportunities, constraints, and limits. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. Eren Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability Part A: Global and Sectoral Aspects Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 899–943). Cambridge University Press.

- Kotcher, J., Feldman, L., Luong, K. T., Wyatt, J., & Maibach, E. (2021). Advocacy messages about climate and health are more effective when they include information about risks, solutions, and a normative appeal: Evidence from a conjoint experiment. *The Journal of Climate Change and Health*, 3(10), 1135–1136. <https://doi.org/10.1016/j.joclim.2021.100030>
- Krause, R. M. (2011). Symbolic or substantive policy? Measuring the extent of local commitment to climate protection. *Environment and Planning. C, Government & Policy*, 29(1), 46–62. <https://doi.org/10.1068/c09185>
- Krause, R. M. (2013). The Motivations Behind Municipal Climate Engagement: An Empirical Assessment of How Local Objectives Shape the Production of a Public Good. *Cityscape: A Journal of Policy Development and Research*, 15(1), 125–142. https://www.huduser.gov/portal/periodicals/cityscpe/vol15num1/Cityscape_March2013_motiv_behind.pdf
- Kuramochi, T., Roelfsema, M., Hsu, A., Lui, S., Weinfurter, A., Chan, S., Hale, T., Clapper, A., Chang, A., & Höhne, N. (2020). Beyond national climate action: the impact of region, city, and business commitments on global greenhouse gas emissions. *Climate Policy*, 20(3), 275–291. <https://doi.org/10.1080/14693062.2020.1740150>
- Kuromizu, K. (n.d.). *Challenge of megacity against climate change countermeasures [Note of JICA expert]*. Japan International Cooperation Agency (JICA). https://www.jica.go.jp/Resource/activities/issues/climate/ku57pq00002cucus-att/policybrief_03_challenge_of_megacity_against_climate_change_countermeasures.pdf
- Lee, T., & Koski, C. (2012). Building green: Local political leadership addressing climate change. *The Review of Policy Research*, 29(5), 605–624. <https://doi.org/10.1111/j.1541-1338.2012.00579.x>
- Lincoln, Y. S., & Guba, E. (2000). Paradigmatic Controversies, Contradictions, and Emerging Confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 163–188). Sage Publications Ltd.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. SAGE Publications.
- Lwasa, S., Seto, K. C., Bai, X., Blanco, H., Gurney, K. R., Kılış, Ş., Lucon, O., Murakami, J., Pan, J., Sharifi, A., & Yamagata, Y. (2022). Urban systems and other settlements. In P. R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. Van Diemen, D. McCollum, M. Pathak, S. Shreya, V. Purvi, F. Roger, B. Malek, H. Apoorva, L. Géninha, L. Sigourney, & M. Juliette (Eds.), *Climate change 2022: Mitigation of climate change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 861–952). Cambridge University Press. <https://doi.org/10.1017/9781009157926.010>
- Maibach, E., Nisbet, M. C., Baldwin, P. K., Akerlof, K., & Diao, G. (2010). Reframing climate change as a public health issue: an exploratory study of public reactions. *BMC Public Health*, 10, 299–299. <https://doi.org/10.1186/1471-2458-10-299>
- Manzini, E., & Staszowski, E. (Eds.). (2013). *Public and collaborative: Exploring the intersection of design, social innovation and public policy*. DESIS Network.
- March, J. G., & Olsen, J. P. (2009). The logic of appropriateness. In *The Oxford Handbook of Public Policy* (pp. 689–708). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199548453.003.0034>

- Mendizabal, M., Feliu, E., Tapia, C., Rajaeifar, M. A., Tiwary, A., Sepúlveda, J., & Heidrich, O. (2021). Triggers of change to achieve sustainable, resilient, and adaptive cities. *City and Environment Interactions*, 12(100071), 100071. <https://doi.org/10.1016/j.cacint.2021.100071>
- MOE. (n.d.-a). *How to declare a zero-carbon city by 2050 (example) [2050 年ゼロカーボンシティの表明方法について (例)]*. Ministry of Environment. Retrieved February 16, 2026, from <https://www.env.go.jp/policy/zerocarbon.html>
- MOE. (n.d.-b). *Local Government Action Plans: Overview and Legal Basis [地方公共団体実行計画: 概要・法的根拠]*. Decarbonized Community Development Support Site [脱炭素地域づくり地域づくり支援サイト]. Retrieved February 16, 2026, from https://policies.env.go.jp/policy/roadmap/local_keikaku/overview/index.html#area-measures
- MOE. (n.d.-c). *Status of local governments declaring their intention to achieve net-zero carbon dioxide emissions by 2050 [地方公共団体における 2050 年二酸化炭素排出実質ゼロ表明の状況]*. Retrieved March 12, 2025, from <https://www.env.go.jp/policy/zerocarbon.html>
- MOE. (2025, December 26). *Local governments that have announced so far (as of December 26, 2025) [これまでに表明した地方公共団体 (2025.12.26 時点)]*. Ministry of Environment. <https://www.env.go.jp/policy/zerocarbon.html>
- Moore, J. (2012). *Social and behavioural aspects of climate change* [Final report from the NESC Secretariat: Ireland's Climate Change Challenge: Connecting 'How much' with 'How To']. NESC. <https://doi.org/10.13140/2.1.4417.7608>
- Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. *Proceedings of the National Academy of Sciences of the United States of America*, 107(51), 22026–22031. <https://doi.org/10.1073/pnas.1007887107>
- Moser, S. C., Ekstrom, J. A., Kim, J., & Heitsch, S. (2019). Adaptation finance archetypes: local governments' persistent challenges of funding adaptation to climate change and ways to overcome them. *Ecology and Society: A Journal of Integrative Science for Resilience and Sustainability*, 24(2). <https://doi.org/10.5751/ES-10980-240228>
- Myasoedov, F., & Ialnazov, D. S. (2025). Key motivations, barriers, and enablers toward net-zero cities: An integrated framework and large survey in Japan. *Climate*, 13(7), 134. <https://doi.org/10.3390/cli13070134>
- Myasoedov, F., & Ota, J. (2021). *Pathway to a Zero Carbon City: Island of Energy, Goto City, Japan [IGES Fact Sheet]*. Institute for Global Environmental Strategies (IGES). <https://doi.org/10.57405/iges-11816>
- Nakazawa, T., Satoh, K., Trencher, G., Tatsumi, T., & Hasegawa, K. (2023). Net-zero carbon declarations by Japanese local governments: What caused the domino-like diffusion? *The Review of Policy Research*. <https://doi.org/10.1111/ropr.12544>
- NEASPEC. (2021). *Comparative Study on Low Carbon City Development in China, Japan, and the Republic of Korea*. UNESCAP East and North-East Asia Office.
- Net Zero Tracker. (2024). *Net Zero Stocktake 2024: Assessing the Status and Trends of Net Zero Target Setting across Countries, Subnational Governments, and Companies*. <https://zerotracker.net/analysis/net-zero-stocktake-2024>

- Neuman, W. (2014). *Social Research Methods: Qualitative and Quantitative Approaches*. Pearson India Education.
- NewClimate Institute. (2021). *Global climate action from cities, regions and businesses: Taking stock of the impact of individual actors and cooperative initiatives on global greenhouse gas emissions*. NewClimate Institute.
<https://newclimate.org/resources/publications/global-climate-action-from-cities-regions-and-businesses-2021>
- Niskanen, W. A. (2017). *Bureaucracy & representative government*. Routledge.
<https://doi.org/10.4324/9781315081878>
- OECD. (2009). *Competitive Cities and Climate Change* (L. Kamal-Chaoui & R. Alexis, Eds.) [OECD Regional Development Working Papers N° 2]. OECD.
- O'Garra, T., Kuz, V., Deneault, A., Orr, C., & Chan, S. (2024). Early engagement and co-benefits strengthen cities' climate commitments. *Nature Cities*, 1(4), 315–324.
<https://doi.org/10.1038/s44284-024-00052-6>
- Ohta, H., & Barrett, B. F. D. (2023). Politics of climate change and energy policy in Japan: Is green transformation likely? *Earth System Governance*, 17(100187), 100187.
<https://doi.org/10.1016/j.esg.2023.100187>
- Okereke, C. (2007). An Exploration of Motivations, Drivers and Barriers to Carbon Management: The UK FTSE 100. *European Management Journal*, 24(6), 475–486.
<https://doi.org/10.1016/j.emj.2007.08.002>
- Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge University Press.
- Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change: Human and Policy Dimensions*, 20(4), 550–557. <https://doi.org/10.1016/j.gloenvcha.2010.07.004>
- Ota, J., & Akagi, J. (2021). *Commitment to Net Zero Carbon Emissions by 2050 by Local Governments in the Kyushu Region of Japan [IGES Issue Brief]*. Institute for Global Environmental Strategies (IGES). <https://doi.org/10.57405/iges-11193>
- Pohl, C. (2011). What is progress in transdisciplinary research? *Futures*, 43(6), 618–626.
<https://doi.org/10.1016/j.futures.2011.03.001>
- Pohl, C., Rist, S., Zimmermann, A., Fry, P., Gurung, G. S., Schneider, F., Speranza, C. I., Kiteme, B., Boillat, S., Serrano, E., Hadorn, G. H., & Wiesmann, U. (2010). Researchers' roles in knowledge co-production: experience from sustainability research in. *Science & Public Policy*, 37(4), 267–281. <https://doi.org/10.3152/030234210X496628>
- Prime Minister of Japan and His Cabinet. (2020, October 26). *Press Conference by the Chief Cabinet Secretary October 26, 2020*.
https://japan.kantei.go.jp/tyoukanpress/202010/26_p.html
- Qi, Y., Ma, L., Zhang, H., & Li, H. (2008). Translating a Global Issue Into Local Priority: China's Local Government Response to Climate Change. *Journal of Environment & Development*, 17(4), 379–400. <https://doi.org/10.1177/1070496508326123>
- Reckien, D., Flacke, J., Olazabal, M., & Heidrich, O. (2015). The Influence of Drivers and Barriers on Urban Adaptation and Mitigation Plans-An Empirical Analysis of European Cities. *PloS One*, 10(8), e0135597. <https://doi.org/10.1371/journal.pone.0135597>

- Renn, O. (2021). Transdisciplinarity: Synthesis towards a modular approach. *Futures*, 130, 102744. <https://doi.org/10.1016/j.futures.2021.102744>
- Rhodes, E., Krawchenko, T., Pearce, K., & Shaw, K. (2021). Scaling up local climate action: A survey of climate policy priorities in the Vancouver Island and Coastal Communities region. *Canadian Planning and Policy / Aménagement et Politique Au Canada*, 2021, 36–69. <https://doi.org/10.24908/cpp-apc.v2021i01.14469>
- Rincón, C. A. R., Santos, J., Volker, L., & Rouwenhorst, R. (2021). Identifying institutional barriers and enablers for sustainable urban planning from a municipal perspective. *Sustainability*, 13(20), 11231. <https://doi.org/10.3390/su132011231>
- Romero-Lankao, P. (2012). Governing carbon and climate in the cities: An overview of policy and planning challenges and options. *European Planning Studies*, 20(1), 7–26. <https://doi.org/10.1080/09654313.2011.638496>
- Romero-Lankao, P., Burch, S., Hughes, S., Auty, K., Aylett, A., Krellenberg, K., Nakano, R., Simon, D., & Ziervogel, G. (2018). Governance and Policy. In C. Rosenzweig, W. Solecki, P. Romero-Lankao, S. Mehrotra, S. Dhakal, & S. A. Ibrahim (Eds.), *ARC3.2 Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network* (pp. 585–606). Cambridge University Press. https://uccrn.ei.columbia.edu/sites/default/files/content/pubs/ARC3.2-PDF-Chapter-16-Governance-and-Policy-wecompress.com_.pdf
- Romero-Lankao, P., & Dodman, D. (2011). Cities in transition: transforming urban centers from hotbeds of GHG emissions and vulnerability to seedbeds of sustainability and resilience: Introduction and Editorial overview. *Current Opinion in Environmental Sustainability*, 3(3), 113–120. <https://doi.org/10.1016/j.cosust.2011.02.002>
- Ruiz-Campillo, X., Castán Broto, V., & Westman, L. (2021). Motivations and intended outcomes in local governments' declarations of climate emergency. *Politics and Governance*, 9(2), 17–28. <https://doi.org/10.17645/pag.v9i2.3755>
- Ryan, D. (2015). From commitment to action: a literature review on climate policy implementation at city level. *Climatic Change*, 131(4). <https://doi.org/10.1007/s10584-015-1402-6>
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, 25(1), 54–67. <https://doi.org/10.1006/ceps.1999.1020>
- Salon, D., Murphy, S., & Sciara, G.-C. (2014). Local climate action: motives, enabling factors and barriers. *Carbon Management*, 5(1), 67–79. <https://doi.org/10.4155/cmt.13.81>
- Samuels, R. J. (2013). *3.11: Disaster and change in Japan*. Cornell University Press.
- Scanu, E., & Cloutier, G. (2015). Why do cities get involved in climate governance? Insights from Canada and Italy. *Environnement Urbain / Urban Environment*, 9. <https://doi.org/10.7202/1036221ar>
- Schonhardt, S. (2025, October 27). *100 countries stall on climate targets ahead of COP30*. E&E News. <https://www.eenews.net/articles/100-countries-stall-on-climate-targets-ahead-of-cop30/#:~:text=Dozens>

- Seth, S., Srivastava, R., Osho, Z., & Harper, S. (2023). *From Planning to Action: Rethinking the Role of Cities in Accelerating Net-Zero Transitions* (T20 Policy Brief, Task Force 4: Refuelling Growth: Clean Energy and Green Transitions). Think20 (T20) India. https://t20ind.org/wp-content/uploads/2023/06/T20_PolicyBrief_TF4_Cities-NetZero.pdf
- Seto, K. C., Churkina, G., Hsu, A., Keller, M., Newman, P. W. G., Qin, B., & Ramaswami, A. (2021). From low- to net-zero carbon cities: The next global agenda. *Annual Review of Environment and Resources*, 46(1), 377–415. <https://doi.org/10.1146/annurev-environ-050120-113117>
- Sippel, M., & Jenssen, T. (2009). What about Local Climate Governance? A Review of Promise and Problems. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.1514334>
- Sippel, M., Shaw, C., & Marshall, G. (2022). *Ten key principles: How to communicate climate change for effective public engagement. Climate Outreach Working Paper*. Climate Outreach, Oxford. <https://doi.org/10.2139/ssrn.4151465>
- Steg, L., Veldstra, J., de Kleijne, K., Kılıkış, Ş., Lucena, A. F. P., Nilsson, L. J., Sugiyama, M., Smith, P., Tavoni, M., de Coninck, H., van Diemen, R., Renforth, P., Mirasgedis, S., Nemet, G., Görsch, R., Muri, H., Bertoldi, P., Cabeza, L. F., Mata, É., ... Verez, D. (2022). A method to identify barriers to and enablers of implementing climate change mitigation options. *One Earth*, 5(11), 1216–1227. <https://doi.org/10.1016/j.oneear.2022.10.007>
- The Global Taskforce of Local and Regional Governments, UCLG. (2021). *Towards the localization of the SDGs: Sustainable and Resilient recovery driven by cities and territories. Local and Regional Governments' Report to the 2021 HLPF*. UCLG. https://www.global-taskforce.org/sites/default/files/2021-07/5th%20report_gtf_hlpf_2021.pdf
- The Ministry of the Interior and Safety. (2021, May 25). *2021 P4G Seoul Summit. Press Release. - All 243 local governments nationwide announce the '2050 Carbon Neutrality Joint Declaration' for the first time in the world -*. The Ministry of the Interior and Safety (MOIS). https://www.mois.go.kr/eng/bbs/type001/commonSelectBoardArticle.do?bbsId=BBSMS TR_000000000019&nttId=84609
- The White House. (2025). Executive Order 14162: Putting America first in international environmental agreements. In *Federal Register* (No. 19; Vol. 90). <https://www.federalregister.gov/d/2025-02010>
- UN Climate Change High-Level Champions. (2022). *Race to Zero & Race to Resilience Progress Report: Taking Stock of Progress - September 2022*. Climate Champions. <https://www.climatechampions.net/media/03bligzg/race-to-zero-race-to-resilience-progress-report.pdf>
- UN Climate Change High-Level Champions. (2024, December). *Race to Zero: Who's In*. <https://www.climatechampions.net/campaigns/race-to-zero/whos-in/>
- UN Secretary-General Ban Ki-moon. (2012). <https://press.un.org/en/2012/sghsm14249.doc.htm>
- UNCRD. (2014). *Japanese Administrative System. UNCRD/AIT-VN Training Course on Management and Administration of Local Government Institutions for Bangladesh*. https://uncrd.un.org/sites/uncrd.un.org/files/20140319-0320_trg-local-govt-insti-bangladesh_p1_japanese-administrative-system.pdf

- UNEP. (2024). Executive Summary. In *Emissions Gap Report 2024: No more hot air ... please! With a massive gap between rhetoric and reality, countries draft new climate commitments*. <https://wedocs.unep.org/20.500.11822/46443>
- UN-Habitat. (2020). *The New Urban Agenda Illustrated, 2020*. UN-Habitat. <https://unhabitat.org/the-new-urban-agenda-illustrated>
- UN-Habitat. (2022). *World cities report 2022: Envisaging the future of cities*. UN-Habitat.
- UN-Habitat, UNESCAP. (2018). *Climate Change and National Urban Policies in Asia and Pacific: A Regional Guide For Integrating Climate Change Concerns Into Urban-Related Policy, Legislative, Financial And Institutional Frameworks*. United Nations. https://unhabitat.org/sites/default/files/2020/06/regionalguide_print_newversion.pdf
- United Nations. (2017). *New Urban Agenda*. United Nations. <https://unhabitat.org/sites/default/files/2019/05/nua-english.pdf>
- United Nations Department of Economic and Social Affairs (UN DESA). (2023). *Effective National to Local Governance for Climate Change Mitigation and Adaptation*. United Nations. https://www.unpog.org/page/sub3_1_view.asp?BoardID=0003&sn=613
- United Nations Environment Programme, Olhoff, A., Bataille, C., Christensen, J., den Elzen, M., Fransen, T., Grant, N., Blok, K., Kejun, J., Soubeyran, E., Lamb, W., Levin, K., Portugal-Pereira, J., Pathak, M., Kuramochi, T., Strinati, C., Roe, S., & Rogelj, J. (2024). *Emissions Gap Report 2024: No more hot air ... please! With a massive gap between rhetoric and reality, countries draft new climate commitments*. United Nations Environment Programme. <https://doi.org/10.59117/20.500.11822/46404>
- Van Bennekom, F. (2017, October 26). *The importance of measuring importance - correctly - on customer surveys*. Great Brook Consulting. <https://greatbrook.com/the-importance-of-measuring-importance-correctly-on-customer-surveys/>
- van der Heijden, J. (2019). Studying urban climate governance: Where to begin, what to look for, and how to make a meaningful contribution to scholarship and practice. *Earth System Governance, 1*, 100005. <https://doi.org/10.1016/j.esg.2019.100005>
- van der Heijden, J. (2021). When opportunity backfires: exploring the implementation of urban climate governance alternatives in three major US cities. *Policy & Society, 40*(1), 116–135. <https://doi.org/10.1080/14494035.2021.1934984>
- van der Heijden, J., Jordan, A., Huitema, D., van Asselt, H., & Forster, J. (2018). City and Subnational Governance. In *Governing Climate Change: Polycentricity in Action?* (pp. 81–96). Cambridge University Press. <https://doi.org/10.1017/9781108284646.006>
- van der Heijden, J., Patterson, J., Juhola, S., & Wolfram, M. (2019). Special section: advancing the role of cities in climate governance – promise, limits, politics. *Journal of Environmental Planning and Management, 62*(3), 365–373. <https://doi.org/10.1080/09640568.2018.1513832>
- Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: towards a research agenda. *Journal of Cleaner Production, 123*(C), 45–54. <https://doi.org/10.1016/j.jclepro.2015.08.053>
- Warming projections global update*. (2025). Climate Action Tracker.
- Weinberg, A. M. (1972). Science and trans-science. *Minerva, 10*(2), 209–222. <https://doi.org/10.1007/bf01682418>

- Williams, M. (2012). Tackling climate change: what is the impact on air pollution? *Carbon Management*, 3(5), 511–519. <https://doi.org/10.4155/cmt.12.49>
- Wittmayer, J. M., & Schäpke, N. (2014). Action, research and participation: roles of researchers in sustainability transitions. *Sustainability Science*, 9(4), 483–496. <https://doi.org/10.1007/s11625-014-0258-4>
- Wurzel, R. K. W., Andersen, M. S., & Tobin, P. (2020). Introduction. In R. K. W. Wurzel, M. S. Andersen, & P. Tobin (Eds.), *Climate governance across the globe: Pioneers, leaders and followers*. Routledge. <https://doi.org/10.4324/9781003014249>
- Yamaguchi, E. (2018). Science and Trans-science. In S. Kawai, M. Fujita, & E. Kawai (Eds.), *Human Survivability Studies: New Paradigm Solving Global Issues*. Kyoto University Press.
- Yamaguchi, E. (2019). *Innovation crisis*. Pan Stanford Publishing.
- Zimmer, A., Jakob, M., & Steckel, J. C. (2015). What motivates Vietnam to strive for a low-carbon economy? — On the drivers of climate policy in a developing country. *Energy for Sustainable Development*, 24, 19–32. <https://doi.org/10.1016/j.esd.2014.10.003>

Appendix A. Survey Questionnaire (in Japanese)

ゼロカーボン担当部署 御中



京都大学

2022年6月吉日

「2050年までにCO2排出実質ゼロ」を達成するための自治体のモチベーション、課題、推進要因に関するアンケート調査のお願い

本日は調査にご協力いただきありがとうございます。

京都大学大学院総合生存学館博士課程のミヤソエードフ・フョードルと申します。

私は現在、「2050年までに二酸化炭素排出実質ゼロ」（ゼロカーボンシティ）を表明した自治体を対象に、ゼロカーボンシティ政策の表明と実施にあたって、どのようなモチベーションや課題、推進要因が最も重要であるかを明らかにすることを目的として、アンケート調査を行っております。この調査を通じて、自治体が直面する重要な問題や効果的な推進要因を明らかにし、それにより自治体が優先的に取り組むべき推奨事項のリストを作成します。

この調査への回答は任意であり、随時、調査への回答を拒否、撤回できます。また、調査への回答を拒否、撤回することによって、皆さま（自治体）が不利な扱いを受けることはありません。

この調査により収集したデータは厳正に管理し、研究発表や学術論文の執筆という学術的な研究目的以外には使用致しません。公開した研究発表や学術論文の貴自治体へのご送付を希望される場合は、予めお知らせください。

大変お忙しいなか、恐れ入りますが、ご協力のほどよろしくお願い致します。

調査実施者：ミヤソエードフ・フョードル（京都大学大学院 総合生存学館 博士一貫課程）



研究指導教員：ヤルナゾフ・ディミター
京都大学大学院 総合生存学館教授



リサーチアシスタント：中西志門（京都大学大学院 人間・環境学研究科博士後期課程）



上記内容を理解した上で、自らの意思に基づいて調査に協力します。

担当者名：_____

ご所属（自治体名・部署等）：_____

電話番号：_____

メールアドレス：_____

（上の情報は連絡目的のみに使用いたします）

**「2050 年までに CO2 排出実質ゼロ」を達成するための自治体の
モチベーション、課題、推進要因に関するアンケート調査**

● ご回答方法

以下 2 つの方法のいずれかでご回答をお願いします。

1. アンケート調査票の PDF ファイルに回答を記入・保存の上、ミャソエードフ・フョードルの下記メールアドレスへ添付して返送する。
※Adobe Acrobat Reader（無料ソフト）が必要です。
2. Google フォームの同様の質問内容に回答する：<https://forms.gle/dhsRVs7KB3iYp6XLA>

ご返送先メールアドレス： myasoedov.fedor.62r@st.kyoto-u.ac.jp

ご返送期限：2022 年 8 月 5 日まで

- この調査は三つのセクション（1. モチベーション、2. 課題、3. 推進要因）からなり、それぞれに要因のリストが並んでいます。貴自治体にとってのそれぞれの要因の重要度を程度が低い「1：特に重要ではない」から、程度が高い「5：非常に重要である」の中からお選びください。
- 「わからない」という選択肢もありますが、なるべく全ての項目について 1 から 5 でご回答ください。
- ゼロカーボン担当部署の方にご回答をお願い致します。
- 選択式の設問のほかに、任意で自由記載していただく欄も設けております。よろしければご回答のほどよろしくお願い致します。
- 記入方法等でご不明点がございましたら、調査実施者のミャソエードフ・フョードルまで（myasoedov.fedor.62r@st.kyoto-u.ac.jp）ご連絡ください。

また、アンケート内容につきまして、今後フォローアップ調査（対面もしくはオンラインのインタビュー調査）にご協力いただけるかご回答をお願いします。

- ☐ フォローアップ調査に協力可能
- ☐ フォローアップ調査に協力できない

I. モチベーション（動機、きっかけ、期待、目的達成の上での原動力）									
カテゴリー	No	項目	詳細、具体例	回答					
設問: 貴自治体がゼロカーボンシティ（2050年までに二酸化炭素排出実質ゼロ）宣言、およびその目標に向けての取り組みを行うにあたってどのようなモチベーションが重要だとお考えでしょうか？下記の項目のモチベーションとしての重要度について、ご回答ください。ゼロカーボン担当部署の方の意見ををお願いします。 （＊モチベーションとは、ここでは、自治体が温室効果ガス排出実質ゼロに取り組みたいと思う理由を指します。）				5: 非常に重要である 4: 重要である 3: どちらかというと重要である 2: あまり重要ではない 1: 特に重要ではない NA: わからない 0 ← 1 2 3 4 5 → より重要					
経済・地域の発展	1.1	財政的メリット	ゼロカーボンシティ政策の実施によってコスト削減と財政的メリットを実現する。例えば、省エネ対策は消費エネルギーの削減とコストカットにつながりうる。省エネ効率の低い建築物をグリーンビルディング（エネルギーや水、空調設備などにより環境性能の高い建物）に改修することで施設の価値が高まる、など。	1	2	3	4	5	NA
	1.2	グリーン成長/地域創生	グリーン成長/循環経済を高めることによって、地域の社会・経済を活性化させる。地球温暖化対策（例えば、再生可能エネルギー導入、省エネの推進、都市機能の集約化、公共交通機関・緑地・地域環境の整備・改善、循環型社会の形成、など）の実施と低炭素産業の育成により得られるビジネスや人材、投資の呼び込み。これらを雇用創出につなげることによる地域経済の活性化。						
	1.3	地域のエネルギー事情の改善	地球温暖化対策（特に自然エネルギー促進）により地域のエネルギー事情を改善する。持続可能/グリーンエナジー政策（再生可能エネルギーの普及、エネルギー地産地消など）を推し進めることによって、地域にメリットをもたらす（エネルギー自給自足と自立、エネルギー収入を地域に循環させる、など）。						
生活の質	2	住民の住みやすさの向上	地球温暖化対策と他の環境政策、社会福祉政策の相乗効果を生み出す。例えば、 ・二酸化炭素の排出量削減は、同時に他の空気汚染物質（PM2.5、NOx、SOxなど）を削減するため、空気の質が向上する。 ・低炭素交通政策は交通渋滞を減らす。 ・都市部の緑化はヒートアイランド現象を減らし、より健康的な都市環境を生み出す、など。						
行政	3	特別な立ち位置を得て、政府と緊密な関係を築くため	政府のインセンティブと気候変動対策に取り組む自治体の枠組みに応える。例えば、自治体は政府の（持続可能/スマート/エコ、など）シティの枠組みに参加することで特別な立ち位置や支援（補助金、技術的・知識的支援）を得ることを期待している。政府のエコシティの枠組みに参加することで、政府との緊密で良好な関係を築くことを望んでいる、など。						

1: 特に重要ではない、2: あまり重要ではない、3: どちらかという重要である、4: 重要である、5: 非常に重要である、NA: わからない

				1	2	3	4	5	NA
政治・社会	4.1	エコ都市としての評判を生み出し、また維持するため	ポジティブなイメージを作り、また維持することで、自治体をエコシティ、グリーン都市として売り込む。例えば、 ・環境政策における自治体のこれまでの業績を維持する、または強化する。 ・エコシティに暮らしているという市民の誇りを育てる。 ・新たな住人やビジネスを呼び込み、その他の潜在的な利益を得る、など。	☐	☐	☐	☐	☐	☐
	4.2	気候政策の機運を生み出し、ゼロカーボンアクションへの注目度を高めるため	気候アクションにおけるリーダーシップを発揮することを目指す。例えば、 ・自治体はエコリーダーとなり、気候政策のパイオニアとして後続の自治体（その他機関）に対してトレンドを示そうとしている。 ・自治体内でのゼロカーボン達成への強い決意を示すことで、国内外のステークホルダーに気候政策の重要性を伝えることを目指している、など。	☐	☐	☐	☐	☐	☐
脆弱性	5	安全の確保（気候変動に起因する災害やエネルギー供給問題から住民を守る）	自治体は悪天候やエネルギー供給の問題に対するリスク管理を目指している。自治体は気候変動の影響に対する脆弱性を改善しようとしている。例えば自治体は海に面しており、海面上昇の問題に直面している。洪水や台風に影響されやすい。近年、自然災害にあった自治体は、災害による被害の再発防止により積極的である、など。また、エネルギー供給面での脆弱性（自治体外のエネルギー供給源への依存、またそれによる供給問題、エネルギー価格の不安定性）への懸念から、エネルギー自給率の向上と供給の安定化を目指している。	☐	☐	☐	☐	☐	☐
国際的規範、利他主義	6	倫理的なモチベーションと最新の国際的トレンドに追いつくため	例えば、 ・気候変動に関する国際組織（IPCC「気候変動に関する政府間パネル」）の報告書や国際合意（パリ協定）に刺激を受けた。 ・自治体は先行する海外の自治体の模範的な取り組みに刺激された。 ・最新の規範や環境フレンドリー都市開発の政策トレンドに追いつくことで、模範的自治体と同等になる。 ・気候変動に取り組む国際的努力に貢献したいという倫理的、利他的動機がある、など。	☐	☐	☐	☐	☐	☐
設問：上の項目（No. 1.1 ～ No. 6）のうち、最も重要なモチベーションを一つ選んでください。空欄に番号をご入力ください。 回答：№									
設問(任意)：この項目が特に重要だと考える理由について、自由に記載してください。 									
設問（任意）：これで「モチベーション」セクションは終わりです。上記の設問の項目について補足がある場合、または、設問の項目の他に重要なモチベーションがある場合は以下の欄で、自由に記載してください。 									

II. 課題									
カテゴリー	No	項目	詳細、具体例	回答					
設問： 貴自治体が、自治体内で2050年までにゼロカーボンシティ（2050年までに二酸化炭素排出実質ゼロ）を達成する上で、現在直面している問題や課題は何ですか。下の項目の課題がどれくらい重大かご回答ください。 ゼロカーボン担当部署の方の意見ををお願いします。				5: 非常に重大である 4: 重大である 3: どちらかというと重大である 2: あまり重大ではない 1: 特に重大ではない NA: わからない 0 より重大 1 2 3 4 5					
行動する 上での自 治体の能 力: 権限 や資源	1.1	気候変動に対して地方自治体担当部署でできることの限界	地方行政において環境担当課（あるいは気候変動に関連する類似の課）にできることが限られている。効果的な気候変動政策を実施する上で担当課の権限が制限されている/あるいは他の課の優先事項と競合している（例、経済成長、福祉など）。	1	2	3	4	5	NA
	1.2	地方自治体が重要な政策分野やインフラ政策への権限を持たない	特定の政策分野やインフラ（電気、交通など）に対する権限を持たないため、二酸化炭素排出量の削減に地方自治体が貢献できることが限られている。例えば、電力事業者に対する強制力を持たないため、省エネや代替エネルギーへの移行が困難である。また、二酸化炭素排出実質ゼロを達成するために自治体とユーティリティ事業者間の協力を促進する国や県などの施策も不十分である。						
	1.3	法的枠組みや権限の不足（気候対策のための法律が不十分、あるいはない）	気候変動に対する地方政策のための法的枠組みなしでは、気候政策は地方自治体の優先事項ではなく、ボランティア活動にとどまり、自立的に施行することが困難である。						
	1.4	予算不足	地方自治体の歳入不足、および国からの補助（地方交付金、国庫支出金）の不足。						
	1.5	外部資金不足	国、都道府県、金融機関、財団などからの外的援助/助成金を確保することに困難がある。						
	1.6	気候政策を実施する上でのコストが高い	二酸化炭素排出量実質ゼロの達成には、多大なコストがかかることが問題であり、その対価（経済的歳入、社会環境的恩恵）を得るまでに通常、長い時間が必要であることがさら問題に拍車をかけている。						
	1.7	担当部署の人員不足	二酸化炭素排出量ゼロ達成に従事する自治体職員が十分な人数ではない。						
	1.8	地元の専門的人材の不足	自治体内の地域において二酸化炭素排出量ゼロ政策に携われる労働力、企業、民間の専門的人材や技術が不足している。						
	設問： 上の項目（No. 1.1 ～ No. 1.8）のうち、最も重大な課題の一つを選んでください。空欄に番号をご入力ください。 回答： No.								
設問（任意）： この課題が特に重大だと考える理由は何か、ご自由にご記入ください。									

1: 特に重大ではない、2: あまり重大ではない、3: どちらかという重大である、4: 重大である、5: 非常に重大である、NA: わからない

			1	2	3	4	5	NA
行動する 上での自 治体の能 力: 知識 や専門性	2.1	適切な気候政策を決定する上での専門性の欠如	地域に適切な潜在的政策オプション全てを特定する上で、自治体の政策立案者側の気候政策面に関する専門性が十分ではない。二酸化炭素排出量ゼロを達成することによって地域が得られるコベネフィット（副次的恩恵）を特定することが困難である。					
	2.2	自治体が気候政策を立案・実行する上で必要な情報にアクセスする上での困難	さまざまな情報源（国・都道府県、他の自治体、民間団体、国際機関、など）での気候変動に関する情報（例えば、自治体内の企業によるGHG排出量に関するデータ）にアクセスする困難。					
	2.3	自治体が地域の気候政策に関するデータを作成することに困難がある	有効な気候政策に必要な、地域の二酸化炭素排出量などの地域専用のデータを作成する上（例、二酸化炭素排出に関するデータベースの作成など）での方法論的問題や技術上の限界など。					
	設問：上の項目（No. 2.1 ～ No. 2.3）のうち、最も重大な課題の一つを選んでください。空欄に番号をご入力ください。 回答：№							
設問（任意）：この項目が特に重大だと考える理由について、自由に記載してください。 								
制度的協 調：縦横 の協力や 民間との 連携	3.1	地域行政における現状のワークフローの変更に関して困難がある	役所の既存の厳格な行動規定や日常業務のため、リスクを冒して新たなアイデアを試したり、通常の業務を離れたりすることができない。					
	3.2	地域行政内で気候政策を行う上での横のつながりの不足。環境課（あるいは類似の課）の業務が孤立している	気候政策には異なる部局（ゴミ処理、交通、都市計画、環境など）の協力が必要だが、縦割り行政のためにそれが困難となっている。また、利害の不一致などにより環境課（あるいは気候変動に関連する類似の課）の業務が他の部署から孤立する、あるいは反抗を受ける。					
	3.3	他の地方自治体との横のつながりの不足	他の地方自治体と共同して二酸化炭素排出実質ゼロを達成することが困難である。					
	3.4	国、県、市町村の縦の協力の不足	国、県、市町村が協力して、気候政策を迅速に、効果的に行う枠組みがない。共有されたビジョンや二酸化炭素排出量ゼロに向けた縦の繋がりを調整し導く明確な枠組みが十分でない。上位の行政機関からの地域気候政策への指導や制約が弱すぎる（十分な方向性を示していない）、あるいは柔軟でない（地域に適した気候政策を導くのに必要なレベルの自由が与えられていない）。					
	3.5	地域のステークホルダーとの協力関係を築くのが困難である	地域のステークホルダー（企業、研究機関、民間団体、住民など）を気候変動政策の立案に関わらせることが困難であり、地域に最も適した対策の選択に関する合意形成と意思決定に十分に関わっていない。また、気候政策の実施を共同で行う上での官民の協力が困難である。					
設問：上の項目（No. 3.1 ～ No. 3.5）のうち、最も重大な課題の一つを選んでください。空欄に番号をご入力ください。 回答：№								

設問(任意)：この項目が特に重大だと考える理由について、自由に記載してください。

1: 特に重大ではない、2: あまり重大ではない、3: どちらかという重大である、4: 重大である、5: 非常に重大である、NA: わからない

政治的意 向・リー ダーシ ップ	4.1	地域政治における気 候政策の指導者の不 在	気候政策を促進し自治体のアジェンダとして二酸化炭素排出実質 ゼロを掲げる政治的指導者(市長、村長、地域政党の党首など)の不 在。リーダーシップの不在によって気候政策が曖昧になり、他の 政策事項に比べて重要度が下がるため、気候行政政策に遅延が生 じる。	1	2	3	4	5	NA
	4.2	国や県からの指導・ 監督不足	二酸化炭素排出ゼロ達成に関する国や県など上位の行政府からの監 督や指導が不足している。	●	●	●	●	●	●
	4.3	現行の自治体の政策 アジェンダが短期的 な政治目標を掲げて いるため、気候政策 が優先されていない	実行的な二酸化炭素排出ゼロ政策が短期的政治目標によって妨げら れている。(これは以下のような事例に現れている。) ・選挙の周期：政治家が任期中に目に見える政策を掲げがちにな る。 ・競合する政治的問題(雇用創出、福祉など)が気候政策を傍に追い やっている。 ・自治体の他の政策と二酸化炭素排出ゼロのシナジー(相乗効果)を見 出せない。	●	●	●	●	●	●
	4.4	気候変動への住民側 からの関心の低さ、 気候政策への参加度 の低さ	地域住民が気候変動をどの程度問題であるかと考えるかは、気候政 策への支持に影響を及ぼす。自治体は啓蒙活動や二酸化炭素排出ゼ ロ政策の実施、意思決定、計画に参加させることによって地域住民 からの支持を得ることが期待できるが、関心の低さからそれが困難 となっている。	●	●	●	●	●	●
	4.5	自治体職員が気候変 動に懐疑的あるいは 問題意識が薄い	自治体内の環境政策を担う部署(例、環境課)以外の部署では気候変動 への問題意識が薄い。	●	●	●	●	●	●
	設問：上の項目（No. 4.1 ～ No. 4.5）のうち、最も重大な課題を一つ選んでください。空欄に番号をご入力ください。 回答：№ 設問(任意)：この項目が特に重大だと考える理由について、自由に記載してください。								
設問(任意)：これで「課題」セクションは終わりです。 上記の設問の項目について補足がある場合、または、設問の項目の他に重大な課題がある場合は以下の欄で、自由に記載してください。									

III. 推進要因（※推進要因とは地球温暖化対策を可能とし、強化・推し進めるような要素のことと定義します。）										
カテゴリー	No	項目	詳細、具体例	回答						
設問： 貴自治体が地球温暖化対策をさらに推し進める上で、どのような推進要因が必要だと思いますか？下記の項目の推進要因としての重要度をご回答ください。 ゼロカーボン担当部署の方の意見ををお願いします。 （※推進要因とは地球温暖化対策を可能とし、強化・推し進めるような要素のことと定義します。）				5: 非常に重要である 4: 重要である 3: どちらかというと重要である 2: あまり重要ではない 1: 特に重要ではない NA: わからない 0 より重要 1 2 3 4 5 →						
行動する 上での自 治体の能 力: 権限 や資源	1.1	担当部署の能力	環境担当課（あるいは気候変動に関連する類似の課）が十分な能力を有しており、自治体の他の部局と有効に協力して気候変動政策に取り組める。	☐	☐	☐	☐	☐	☐	NA
	1.2	自治体が重要な政策分野やインフラへの一定の権限を有している	官民パートナーシップなどによって自治体がインフラ（電力/ガス/公共交通機関など）へのより大きな権限を有しているため、温室効果ガス排出量削減対策への影響力を及ぼせる。	☐	☐	☐	☐	☐	☐	☐
	1.3	法的枠組みの存在	国の温室効果ガスを削減するという枠組みにしたがって、自治体は政府の監督のもと気候政策に取り組むことができる。	☐	☐	☐	☐	☐	☐	☐
	1.4	財源の存在	十分な歳入/税収がある、あるいは国からの補助（地方交付金、国庫支出金）がある。	☐	☐	☐	☐	☐	☐	☐
	1.5	外部資金の存在	国、都道府県、金融機関、財団などからの外的援助/助成金がある。	☐	☐	☐	☐	☐	☐	☐
	1.6	コストを上回るメリットがある	自治体は温室効果ガス排出量削減を他のSDGs政策の達成と効果的に結びつけることができる。気候政策に取り組むことでSDGsを達成することによる恩恵は、コストが高くても追求する価値がある。	☐	☐	☐	☐	☐	☐	☐
	1.7	担当部署の人員が足りている	気候政策に取り組む部署に十分な人員が割り当てられている。	☐	☐	☐	☐	☐	☐	☐
	1.8	十分な数の専門的人材と技術がある	民間の低炭素産業の分野における専門的人材、技術者が自治体内の地域において存在する。	☐	☐	☐	☐	☐	☐	☐
	設問： 上の項目（No. 1.1 ～ No. 1.8）のうち、最も重要な推進要因を一つ選んでください。空欄に番号をご入力ください。 回答： No.									
設問（任意）： この項目が特に重要だと考える理由について、自由に記載してください。 										
行動する 上での自 治体の能 力: 知識 や専門性	2.1	適切な気候政策を決定する上での専門的知識がある	気候政策とSDGsの相乗効果が明確であり、地域にとって適切な気候政策の立案に際して相乗効果が助案されている。	☐	☐	☐	☐	☐	☐	☐
	2.2	自治体が気候政策を立案・実行する上で必要な情報にアクセスできる	さまざまな情報源（国・都道府県、他の自治体、民間団体、国際機関、など）での気候変動に関する情報にアクセスできる（例えば、自治体内の企業によるGHG排出量に関するデータ）。	☐	☐	☐	☐	☐	☐	☐

1: 特に重要ではない、2: あまり重要ではない、3: どちらかという重要である、4: 重要である、5: 非常に重要である、NA: わからない

			1	2	3	4	5	NA
2.3	自治体が地域の気候政策に関するデータを作成できる	例えば、気候変動に取り組む都市間のネットワークのメンバーであることによって、気候変動対策に関する情報やノウハウ（温室効果ガス排出量の計算方法や温室効果ガス排出量削減に取り組む事例など）を集めることができる。また、それによって自治体は温室効果ガス排出量削減に取り組むための政策を立案することが可能となる。	●	●	●	●	●	●
設問：上の項目（No. 2.1 ～ No. 2.3）のうち、最も重要な推進要因の一つを選んでください。空欄に番号をご入力ください。 回答：№								
設問(任意)：この項目が特に重要だと考える理由について、自由に記載してください。 								
制度的協 調：縦横 の協力	3.1	気候政策に関心を持つ行政職員がいる	●	●	●	●	●	●
	3.2	地域行政内で気候政策を行う上での横のつながりがあり、環境課は他の部署と効果的に共同して作業できる	●	●	●	●	●	●
	3.3	気候変動に対する他の地方自治体との横のつながりや協力関係がある	●	●	●	●	●	●
	3.4	国、県、市町村の縦の協力がある	●	●	●	●	●	●

1: 特に重要ではない、2: あまり重要ではない、3: どちらかという重要である、4: 重要である、5: 非常に重要である、NA: わからない

			1	2	3	4	5	NA
3.5	ステークホルダーが参画して気候対策や意思決定を調整する協力関係が作られている	地域のステークホルダー（企業、研究機関、民間団体、住民など）が気候変動政策の立案に参加し、地域に最も適した対策（例、気候行動計画の作成と刷新）の選択に関する合意形成と意思決定に十分に関わっている。また、気候政策の実施を共同で行う上での官民の協力が形成されている。	☒	☒	☒	☒	☒	☒
設問：上の項目（No. 3.1 ～ No. 3.5）のうち、最も重要な推進要因を一つ選んでください。空欄に番号をご入力ください。 回答：№								
設問(任意)：この項目が特に重要だと考える理由について、自由に記載してください。 								
政治的意 向・リー ダーシッ プ	4.1	地域政治における気候政策の指導者がいる	気候政策を促進し自治体のアジェンダとして二酸化炭素排出実質ゼロを掲げる政治的指導者(市長、村長、地域政党の党首など)がいる。そのような指導者は低炭素都市開発への共有された将来的ヴィジョンを生み出し、そのために自治体を様々な利害のバランスを取る方向へ導いている。	☒	☒	☒	☒	☒
	4.2	気候（二酸化炭素排出実質ゼロ）アジェンダが国や与党によって推し進められている	政府によって国の気候政策に取り組むことは重要な問題であると認識されており、長期的成長の包括的計画に含められている。自治体は国の強力な政治的リーダーシップと二酸化炭素排出実質ゼロへのヴィジョンに促されている。	☒	☒	☒	☒	☒
	4.3	長年にわたって自治体の政策アジェンダにおいて気候政策が優先されている	たとえば、 - 地域の他の開発目標との相乗効果が明確である。 - 気候政策に取り組んできた政治家が長年再選されている。 - 自治体が環境問題に取り組んできた歴史がある、など。	☒	☒	☒	☒	☒
	4.4	気候政策を要求する政治的に活動的な市民社会がある	たとえば、 - 地域住民の気候変動に関する意識が高い。 - 地域住民がグリーン都市としてのイメージを地域のアイデンティティであり、市民の誇りであると考えている。 - 自治体は活動的な市民や市民団体（NPOやNGO）からの気候政策を要求する声に応えている。	☒	☒	☒	☒	☒
設問：上の項目（No. 4.1 ～ No. 4.4）のうち、最も重要な推進要因を一つ選んでください。空欄に番号をご入力ください。 回答：№								
設問(任意)：この項目が特に重要だと考える理由について、自由に記載してください。 								
設問(任意)：これで「推進要因」セクションは終わりです。上記の設問の項目について補足がある場合、または、設問の項目の他に重要な推進要因がある場合は以下の欄で、自由に記載してください。 								

Appendix B. List of Respondents

N	Prefecture	Code	Municipality	Popula- tion	Type	Date of declara- tion	Respondent Affiliation	Affiliation category
1	Hokkaidō	01204	Asahikawa-shi	329,306	city	2021/10/22	Environment Department, Environmental General Affairs Division	Env. Dept.
2	Hokkaidō	01206	Kushiro-shi	165,077	city	2021/02/26	Citizen Environment Department, Environmental Conservation Division	Env. Dept.
3	Hokkaidō	01213	Tomakomai-shi	170,113	city	2021/08/24	Environmental Hygiene Department, Environmental Conservation Division	Env. Dept.
4	Hokkaidō	01221	Nayoro-shi	27,282	city	2021/11/04	General Policy Department, General Policy Division	Planning / Policy
5	Hokkaidō	01229	Furano-shi	21,131	city	2021/04/16	Citizen Life Department, Environment Division	Citizen Affairs
6	Hokkaidō	01235	Ishikari-shi	56,869	city	2020/12/08	Environment and Citizen Department, Environment Division	Env. Dept.
7	Hokkaidō	01303	Tobetsu-cho	15,916	town, village	2021/04/16	Economic Department, Zero Carbon Promotion Office, Zero Carbon Promotion Section	Industry / Economy
8	Hokkaidō	01395	Niseko-cho	5,074	town, village	2020/07/21	Planning and Environment Division, Environmental Model City Promotion Section	Planning / Policy
9	Hokkaidō	01397	Rusutsu-mura	1,911	town, village	2022/01/20	Resident Welfare Division	Welfare / Social
10	Hokkaidō	01433	Moseushi-cho	2,693	town, village	2021/12/16	Resident Division, Resident Group	Citizen Affairs
11	Hokkaidō	01434	Chippubetsu-cho	2,329	town, village	2021/12/09	Planning Division	Planning / Policy
12	Hokkaidō	01633	Kamishihoro-cho	4,778	town, village	2021/12/24	Zero Carbon Promotion Division	Env. Dept.
13	Hokkaidō	01634	Shikaoi-cho	5,266	town, village	2021/03/12	Planning Division	Planning / Policy
14	Hokkaidō	01636	Shimizu-cho	9,094	town, village	2021/09/13	Resident Life Division	Citizen Affairs
15	Hokkaidō	01641	Taiki-cho	5,420	town, village	2021/12/06	Planning and Commerce Division, Planning Section	Industry / Economy
16	Hokkaidō	01661	Kushiro-cho	19,105	town, village	2021/12/10	Environment and Living Division	Citizen Affairs
17	Hokkaidō	01662	Akkeshi-cho	8,892	town, village	2021/03/08	Environment and Forestry Division, Environmental Hygiene Section	Env. Dept.
18	Hokkaidō	01665	Teshikaga-cho	6,955	town, village	2021/12/10	Community Development Policy Division	Planning / Policy
19	Hokkaidō	01694	Rausu-cho	4,722	town, village	2021/03/16	Environment and Living Division	Citizen Affairs
20	Aomori	02203	Hachinohe-shi	223,415	city	2021/06/01	Environmental Policy Division	Env. Dept.
21	Aomori	02209	Tsugaru-shi	30,934	city	2021/09/02	Regional Revitalization Division	Planning / Policy
22	Aomori	02323	Fukaura-machi	7,346	town, village	2021/09/10	Resident Division	Citizen Affairs
23	Aomori	02402	Shichinohe-machi	14,556	town, village	2021/07/07	Planning and Coordination Division	Planning / Policy
24	Aomori	02426	Sai-mura	1,788	town, village	2021/10/04	Comprehensive Strategy Division	Planning / Policy
25	Iwate	03202	Miyako-shi	50,369	city	2020/11/11	Energy and Environment Department, Environment Division	Env. Dept.
26	Iwate	03209	Ichinoseki-shi	111,932	city	2021/02/22	Citizen Environment Department, Living Environment Division	Citizen Affairs
27	Iwate	03211	Kamaishi-shi	32,078	city	2021/10/29	Citizen Life Department, Living Environment Division	Citizen Affairs
28	Iwate	03214	Hachimantai-shi	24,023	city	2020/02/19	Citizen Division	Citizen Affairs
29	Iwate	03302	Kuzumaki-machi	5,634	town, village	2019/12/02		Not Specified

30	Iwate	03485	Fudai-mura	2,487	town, village	2019/12/02	Policy Promotion Office	Planning / Policy
31	Iwate	03501	Karumai-machi	8,421	town, village	2019/12/02	Renewable Energy Promotion Office	Env. Dept.
32	Iwate	03506	Kunohe-mura	5,378	town, village	2019/12/02	IJU Strategy Office	Planning / Policy
33	Miyagi	04100	Sendai-shi	1,096,704	designated city	2021/02/05	Environment Bureau, Global Warming Countermeasures Promotion Division	Env. Dept.
34	Miyagi	04205	Kesennuma-shi	61,147	city	2021/11/04	Living Environment Division	Citizen Affairs
35	Miyagi	04207	Natori-shi	78,718	city	2021/02/16	Clean Measures Division	Env. Dept.
36	Akita	05204	Odate-shi	69,237	city	2021/03/04	Citizen Department, Environment Division	Citizen Affairs
37	Akita	05368	Ogata-mura	3,011	town, village	2020/10/19	Living Environment Division	Citizen Affairs
38	Yamagata	06201	Yamagata-shi	247,590	city	2020/10/08	Environment Department, Environment Division	Env. Dept.
39	Yamagata	06202	Yonezawa-shi	81,252	city	2021/04/20	Citizen Environment Department, Living Environment Division	Citizen Affairs
40	Yamagata	06203	Tsuruoka-shi	122,347	city	2020/01/31	Citizen Department, Environment Division	Citizen Affairs
41	Yamagata	06211	Higashine-shi	47,682	city	2021/12/09	Citizen Life Department, Living Environment Division	Citizen Affairs
42	Yamagata	06362	Mogami-machi	8,080	town, village	2021/11/03	Commerce and Tourism Division, Energy Industry Promotion Office	Industry / Economy
43	Yamagata	06402	Shirataka-machi	12,890	town, village	2020/12/15	Resident Division, Living Environment Section	Citizen Affairs
44	Yamagata	06403	Iide-machi	6,613	town, village	2020/11/07	Resident Division, Living Environment Office	Citizen Affairs
45	Yamagata	06428	Shonai-machi	20,151	town, village	2021/12/27		Not Specified
46	Fukushima	07202	Aizuwakamatsu-shi	117,376	city	2019/11/28	Citizen Department, Living Environment Division	Citizen Affairs
47	Fukushima	07203	Koriyama-shi	327,692	city	2021/09/16	Environment Department, Environmental Policy Division	Env. Dept.
48	Fukushima	07208	Kitakata-shi	44,760	city	2021/03/18	Citizen Department, Citizen Life Division	Citizen Affairs
49	Fukushima	07214	Motomiya-shi	30,236	city	2021/03/07	Citizen Department, Living Environment Division	Citizen Affairs
50	Fukushima	07542	Naraha-machi	3,710	town, village	2020/03/05	Living Safety Measures Division	Citizen Affairs
51	Fukushima	07547	Namie-machi	1,923	town, village	2020/07/28	Industrial Promotion Division, New Energy Promotion Section	Industry / Economy
52	Ibaraki	08201	Mito-shi	270,685	city	2020/07/28	Living Environment Department, Environmental Conservation Division	Citizen Affairs
53	Ibaraki	08203	Tsuchiura-shi	142,074	city	2020/07/28	Citizen Life Department, Environmental Conservation Division	Citizen Affairs
54	Ibaraki	08204	Koga-shi	139,344	city	2021/01/19	Environment Division	Env. Dept.
55	Ibaraki	08210	Shimotsuma-shi	42,521	city	2020/07/28	Living Environment Division	Citizen Affairs
56	Ibaraki	08211	Joso-shi	60,834	city	2020/07/28	Living Environment Division	Citizen Affairs
57	Ibaraki	08215	Kitairaraki-shi	41,801	city	2021/04/01	Living Environment Division	Citizen Affairs
58	Ibaraki	08216	Kasama-shi	73,173	city	2021/03/11	Environmental Policy Division, Decarbonization Promotion Office	Env. Dept.
59	Ibaraki	08221	Hitachinaka-shi	156,581	city	2020/07/28	Economic and Environment Department, Environmental Policy Division	Env. Dept.
60	Ibaraki	08223	Itako-shi	27,604	city	2020/07/28	Environment and Economy Department, Environment Division	Env. Dept.
61	Ibaraki	08224	Moriya-shi	68,421	city	2020/07/28	Living and Economy Department, Living Environment Division	Citizen Affairs
62	Ibaraki	08226	Naka-shi	53,502	city	2020/07/28	Citizen Life Department, Environment Division	Citizen Affairs
63	Ibaraki	08231	Sakuragawa-shi	39,122	city	2020/07/28	Citizen Life Department, Living Environment Division	Citizen Affairs

64	Ibaraki	08302	Ibaraki-machi	31,401	town, village	2021/09/06	Living and Economy Department, Green Environment Division	Citizen Affairs
65	Tochigi	09201	Utsunomiya-shi	518,757	city	2021/01/07	Environment Department, Environmental Policy Division	Env. Dept.
66	Tochigi	09205	Kanuma-shi	94,033	city	2021/12/24	Environment Department, Environment Division	Env. Dept.
67	Tochigi	09206	Nikko-shi	77,661	city	2020/07/28	Citizen Environment Department, Living Environment Division, Climate Change Measures Section	Citizen Affairs
68	Tochigi	09210	Ohtawara-shi	72,087	city	2019/12/03	Citizen Life Department, Living Environment Division	Citizen Affairs
69	Tochigi	09213	Nasushiobara-shi	115,210	city	2020/07/28	Climate Change Measures Division	Env. Dept.
70	Tochigi	09215	Nasukarasuyama-shi	24,875	city	2020/07/28	Community Development Division	Planning / Policy
71	Tochigi	09411	Nakagawa-machi	15,215	town, village	2021/04/22	Living Environment Division	Citizen Affairs
72	Gunma	10201	Maebashi-shi	332,149	city	2020/01/07	Environment Department, Environment and Forestry Division	Env. Dept.
73	Gunma	10205	Ota-shi	223,014	city	2021/01/13	Industry and Environment Department, Decarbonization Promotion Office	Env. Dept.
74	Gunma	10207	Tatebayashi-shi	75,309	city	2020/07/28	Global Environment Division, Environmental Policy Section	Env. Dept.
75	Gunma	10209	Fujioka-shi	63,261	city	2021/12/17	Forest and Environment Department, Environment Division	Env. Dept.
76	Gunma	10212	Midori-shi	49,648	city	2020/07/28	Citizen Department, Living Environment Division	Citizen Affairs
77	Gunma	10367	Kanna-machi	1,645	town, village	2021/01/18	Resident Life Division	Citizen Affairs
78	Gunma	10425	Tsumagoi-mura	8,850	town, village	2020/07/28	Future Creation Division	Planning / Policy
79	Gunma	10449	Minakami-machi	17,195	town, village	2021/05/01	General Strategy Division	Planning / Policy
80	Saitama	11201	Kawagoe-shi	354,571	city	2022/01/05	Environment Department, Environmental Policy Division	Env. Dept.
81	Saitama	11206	Gyoda-shi	78,617	city	2019/12/06	Environment and Economy Department, Environment Division	Env. Dept.
82	Saitama	11207	Chichibu-shi	59,674	city	2021/05/04	Environment Department, Environment Division	Env. Dept.
83	Saitama	11211	Honjo-shi	78,569	city	2021/03/11	Economy and Environment Department, Environment Promotion Division	Env. Dept.
84	Saitama	11214	Kasukabe-shi	229,792	city	2021/10/01	Environment and Economy Department, Environmental Policy Division	Env. Dept.
85	Saitama	11217	Konosu-shi	116,828	city	2021/04/26	Environment and Economy Department, Environment Division, Planning Section	Env. Dept.
86	Saitama	11221	Soka-shi	248,304	city	2021/04/26	Environment Division	Env. Dept.
87	Saitama	11222	Koshigaya-shi	341,621	city	2021/02/15	Environment and Economy Department, Environmental Policy Division	Env. Dept.
88	Saitama	11225	Iruma-shi	145,651	city	2021/04/22	Environment and Economy Department, Eco-Clean Policy Division	Env. Dept.
89	Saitama	11232	Kuki-shi	150,582	city	2021/04/26	Environment and Economy Department, Environment Division	Env. Dept.
90	Saitama	11237	Misato-shi	142,145	city	2021/04/26	Clean Life Division	Citizen Affairs
91	Saitama	11243	Yoshikawa-shi	71,979	city	2021/12/01	Environment Division	Env. Dept.
92	Saitama	11347	Yoshimi-machi	18,192	town, village	2021/04/26	Environment Division	Env. Dept.
93	Saitama	11465	Matsubushi-machi	28,266	town, village	2021/02/16	Environment and Economy Division	Env. Dept.
94	Chiba	12202	Choshi-shi	58,431	city	2021/02/26	Planning Division, Offshore Wind Promotion Office	Planning / Policy
95	Chiba	12204	Funabashi-shi	642,907	city	2021/08/30	Zero Carbon City Promotion Office	Env. Dept.

96	Chiba	12205	Tateyama-shi	45,153	city	2021/02/10	Construction and Environment Department, Environment Division	Urban / Public Works
97	Chiba	12206	Kisarazu-shi	136,166	city	2020/11/25	Environment Department, Environmental Policy Division	Env. Dept.
98	Chiba	12211	Narita-shi	132,906	city	2021/08/18	Environment Department, Environmental Planning Division	Env. Dept.
99	Chiba	12212	Sakura-shi	168,743	city	2020/12/07	Environment Department, Living Environment Division	Citizen Affairs
100	Chiba	12221	Yachiyo-shi	199,498	city	2020/07/28	Economy and Environment Department, Environmental Conservation Division, Environmental Policy Office	Env. Dept.
101	Chiba	12222	Abiko-shi	130,510	city	2021/09/01	Environment and Economy Department, Teganuma Division	Env. Dept.
102	Chiba	12225	Kimitsu-shi	82,206	city	2020/07/28	Environment and Economy Department, Environment and Green Promotion Office	Env. Dept.
103	Chiba	12228	Yotsukaido-shi	93,576	city	2021/08/31	Environmental Policy Division	Env. Dept.
104	Chiba	12234	Minamiboso-shi	35,831	city	2021/03/30	Construction and Environment Department, Environmental Conservation Division	Urban / Public Works
105	Tōkyō	13102	Chuo-ku	169,179	ward (of Tokyo)	2021/06/05	Environment and Civil Engineering Department, Environment Division, Zero Carbon Promotion Section	Urban / Public Works
106	Tōkyō	13104	Shinjuku-ku	349,385	ward (of Tokyo)	2021/10/05	Environmental Measures Division	Env. Dept.
107	Tōkyō	13107	Sumida-ku	272,085	ward (of Tokyo)	2020/10/16	Urban Development Department, Environment Division	Urban / Public Works
108	Tōkyō	13112	Setagaya-ku	943,664	ward (of Tokyo)	2021/10/28	Environmental Planning Division	Env. Dept.
109	Tōkyō	13114	Nakano-ku	344,880	ward (of Tokyo)	2021/02/18	Environment Department, Environment Division	Env. Dept.
110	Tōkyō	13116	Toshima-ku	301,599	ward (of Tokyo)	2021/06/24	Environment and Sanitation Department, Environmental Policy Division	Env. Dept.
111	Tōkyō	13117	Kita-ku	355,213	ward (of Tokyo)	2021/06/22	Living Environment Department, Environment Division, Environmental Policy Section	Citizen Affairs
112	Tōkyō	13118	Arakawa-ku	217,475	ward (of Tokyo)	2021/03/23	Environment and Sanitation Department, Environment Division	Env. Dept.
113	Tōkyō	13121	Adachi-ku	695,043	ward (of Tokyo)	2020/02/06	Environment Department, Environmental Policy Division	Env. Dept.
114	Tōkyō	13122	Katsushika-ku	453,093	ward (of Tokyo)	2021/02/24	Environment Division	Env. Dept.
115	Tōkyō	13203	Musashino-shi	150,149	city	2021/03/05	Environmental Policy Division	Env. Dept.
116	Tōkyō	13208	Chofu-shi	242,614	city	2022/01/24	Environmental Policy Division	Env. Dept.
117	Tōkyō	13209	Machida-shi	431,079	city	2021/03/25	Environmental Policy Division	Env. Dept.
118	Tōkyō	13215	Kunitachi-shi	77,130	city	2021/03/26	Living Environment Department, Environmental Policy Division	Citizen Affairs
119	Tōkyō	13219	Komae-shi	84,772	city	2020/06/25	Environment Department, Environmental Policy Division, Environment Section	Env. Dept.
120	Tōkyō	13224	Tama-shi	146,951	city	2019/06/17	Environment Department, Environmental Policy Division	Env. Dept.
121	Kanagawa	14100	Yokohama-shi	3,777,491	designated city	2020/02/17	Global Warming Countermeasures Headquarters, Coordination Division	Env. Dept.
122	Kanagawa	14130	Kawasaki-shi	1,538,262	designated city	2020/09/30	Environment Bureau, Decarbonization Strategy Promotion Office	Env. Dept.
123	Kanagawa	14150	Sagamihara-shi	725,493	designated city	2021/01/29	Zero Carbon Promotion Division	Env. Dept.
124	Kanagawa	14201	Yokosuka-shi	388,078	city	2021/02/15	Environment Department, Zero Carbon Promotion Division	Env. Dept.
125	Kanagawa	14205	Fujisawa-shi	436,905	city	2019/11/22	Environment Department, Environmental General Affairs Division	Env. Dept.
126	Kanagawa	14206	Odawara-shi	188,856	city	2021/04/01	Zero Carbon Promotion Division	Env. Dept.
127	Kanagawa	14207	Chigasaki-shi	242,389	city	2020/05/07	Environmental Policy Division	Env. Dept.

128	Kanagawa	14210	Miura-shi	42,069	city	2021/02/26	Urban Environment Department, Environment Division	Env. Dept.
129	Kanagawa	14211	Hadano-shi	162,439	city	2021/10/22	Environmental Coexistence Division	Env. Dept.
130	Kanagawa	14214	Isehara-shi	101,780	city	2021/04/01	Economy and Environment Department, Environmental Measures Division	Env. Dept.
131	Kanagawa	14321	Samukawa-machi	48,348	town, village	2021/04/20	Environment and Economy Department, Environment Division	Env. Dept.
132	Kanagawa	14363	Matsuda-machi	10,836	town, village	2020/12/01	Environment and Waterworks Division	Urban / Public Works
133	Niigata	15100	Niigata-shi	789,275	designated city	2020/12/17	Environmental Policy Division	Env. Dept.
134	Niigata	15205	Kashiwazaki-shi	81,526	city	2021/06/23	Citizen Life Department, Environment Division	Citizen Affairs
135	Niigata	15206	Shibata-shi	94,927	city	2021/11/30	Environmental Hygiene Division	Env. Dept.
136	Niigata	15208	Ojiya-shi	34,096	city	2020/06/08	Citizen Life Division	Citizen Affairs
137	Niigata	15210	Tokamachi-shi	49,820	city	2021/06/04	Environment and Energy Department, Environmental Hygiene Division	Env. Dept.
138	Niigata	15212	Murakami-shi	57,418	city	2020/02/23	Environment Division	Env. Dept.
139	Niigata	15224	Sado-shi	51,492	city	2021/03/23	General Policy Division	Planning / Policy
140	Niigata	15482	Tsunan-machi	8,989	town, village	2021/03/01	General Affairs Division	General Affairs
141	Toyama	16201	Toyama-shi	413,938	city	2020/02/24	Environment Department, Environmental Policy Division	Env. Dept.
142	Toyama	16204	Uozu-shi	40,535	city	2021/12/17	Planning and Policy Division	Planning / Policy
143	Toyama	16209	Oyabe-shi	28,983	city	2020/08/06	Civil Affairs Department, Living Environment Division	Citizen Affairs
144	Toyama	16210	Nanto-shi	47,937	city	2020/10/01	General Policy Department, Eco-Village Promotion Division	Planning / Policy
145	Toyama	16323	Tateyama-machi	24,792	town, village	2020/03/03	Beautiful Town Development Promotion Office	Planning / Policy
146	Ishikawa	17201	Kanazawa-shi	463,254	city	2020/02/25	Environment Bureau, Environmental Policy Division, Zero Carbon City Promotion Office	Env. Dept.
147	Ishikawa	17206	Kaga-shi	63,220	city	2021/03/24	Industry Promotion Department, Environment Division	Industry / Economy
148	Fukui	18201	Fukui-shi	262,328	city	2021/07/01	Citizen Life Department, Environmental Policy Division	Citizen Affairs
149	Fukui	18202	Tsuruga-shi	64,264	city	2021/03/25	Planning and Policy Department, Hometown Revitalization Division	Planning / Policy
150	Fukui	18205	Ono-shi	31,286	city	2021/03/05	Environment and Water Cycle Division	Env. Dept.
151	Fukui	18210	Sakai-shi	88,481	city	2021/02/15	Environment Promotion Division	Env. Dept.
152	Yamanashi	19201	Kofu-shi	189,591	city	2021/02/15	Environmental Policy Division	Env. Dept.
153	Yamanashi	19204	Tsuru-shi	31,016	city	2021/02/15	Citizen Department, Regional Environment Division	Citizen Affairs
154	Yamanashi	19206	Otsuki-shi	22,512	city	2021/02/15	Citizen Life Department, Citizen Division, Living Environment Section	Citizen Affairs
155	Yamanashi	19207	Nirasaki-shi	29,067	city	2020/07/28	Citizen Life Division, Living Environment Section	Citizen Affairs
156	Yamanashi	19210	Kai-shi	75,313	city	2020/07/28	Decarbonized Society Promotion Office	Env. Dept.
157	Yamanashi	19211	Fuefuki-shi	66,947	city	2020/07/28	Citizen Environment Department, Environment Promotion Division	Citizen Affairs
158	Yamanashi	19212	Uenohara-shi	22,669	city	2021/02/15	Citizen Department, Living Environment Division	Citizen Affairs
159	Yamanashi	19213	Koshu-shi	29,237	city	2020/07/28	Environment Division	Env. Dept.
160	Yamanashi	19214	Chuo-shi	31,216	city	2020/07/28	Citizen Environment Division	Citizen Affairs
161	Yamanashi	19346	Ichikawamisato-cho	14,700	town, village	2021/02/15	Living Environment Division	Citizen Affairs

162	Yamanashi	19364	Hayakawa-cho	1,098	town, village	2021/02/15		Not Specified
163	Yamanashi	19365	Minobu-cho	10,663	town, village	2020/07/28	Environment and Waterworks Division	Urban / Public Works
164	Yamanashi	19384	Showa-cho	20,909	town, village	2021/02/15	Environment and Economy Division	Env. Dept.
165	Yamanashi	19422	Doshi-mura	1,607	town, village	2021/02/15	Industrial Promotion Division	Industry / Economy
166	Yamanashi	19430	Fujikawaguchiko-machi	26,082	town, village	2021/02/15	Environment Division	Env. Dept.
167	Yamanashi	19443	Tabayama-mura	530	town, village	2020/12/21	Resident Life Division	Citizen Affairs
168	Nagano	20202	Matsumoto-shi	241,145	city	2021/02/19	Environment and Regional Energy Division	Env. Dept.
169	Nagano	20203	Ueda-shi	154,055	city	2021/03/19	Living Environment Department, Living Environment Division	Citizen Affairs
170	Nagano	20205	Iida-shi	98,164	city	2020/06/05	Zero Carbon City Promotion Division	Env. Dept.
171	Nagano	20385	Minamiminowa-mura	15,797	town, village	2021/03/02	Resident Environment Division	Citizen Affairs
172	Nagano	20403	Takamori-machi	12,811	town, village	2020/02/28	Environment and Waterworks Division, Environment Section	Urban / Public Works
173	Nagano	20481	Ikeda-machi	9,382	town, village	2021/03/25	Resident Division, Environment Section	Citizen Affairs
174	Gifu	21206	Nakatsugawa-shi	76,570	city	2021/03/12	Environment and Waterworks Department, Environmental Policy Division	Env. Dept.
175	Gifu	21209	Hashima-shi	65,649	city	2021/02/26	Living Environment Department, Living Environment Division	Citizen Affairs
176	Gifu	21219	Gujo-shi	38,997	city	2021/12/07	Environment and Waterworks Department, Environment Division	Env. Dept.
177	Gifu	21403	Ono-cho	22,041	town, village	2021/01/13	Environment and Living Division	Citizen Affairs
178	Shizuoka	22207	Fujinomiya-shi	128,105	city	2021/03/30	Environment Planning Division, Environment and Energy Office	Env. Dept.
179	Shizuoka	22209	Shimada-shi	95,719	city	2021/04/07	Regional Life Department, Environment Division	Citizen Affairs
180	Shizuoka	22210	Fuji-shi	245,392	city	2021/02/15	Environment Department, Environmental General Affairs Division	Env. Dept.
181	Shizuoka	22214	Fujieda-shi	141,342	city	2020/02/03	Environmental Policy Division	Env. Dept.
182	Shizuoka	22215	Gotemba-shi	86,614	city	2021/10/05	Environment Department, Environment Division	Env. Dept.
183	Shizuoka	22220	Susono-shi	50,911	city	2021/07/21	Environment and Citizen Department, Living Environment Division	Citizen Affairs
184	Shizuoka	22221	Kosai-shi	57,885	city	2021/02/15	Environment Department, Environment Division	Env. Dept.
185	Shizuoka	22223	Omaezaki-shi	31,103	city	2021/11/06	Citizen Life Department, Environment Division	Citizen Affairs
186	Aichi	23201	Toyohashi-shi	371,920	city	2020/02/27	Environment Department, Zero Carbon City Promotion Division	Env. Dept.
187	Aichi	23202	Okazaki-shi	384,654	city	2021/06/22	Environment Department, Zero Carbon City Promotion Division	Env. Dept.
188	Aichi	23206	Kasugai-shi	308,681	city	2021/03/02	Environment Department, Environmental Policy Division	Env. Dept.
189	Aichi	23214	Gamagori-shi	79,538	city	2021/06/09	Environmental Sanitation Division	Env. Dept.
190	Aichi	23219	Komaki-shi	148,831	city	2021/01/07	Citizen Life Department, Environmental Measures Division	Citizen Affairs
191	Aichi	23223	Obu-shi	93,123	city	2021/08/23	Citizen Collaboration Department, Environment Division	Citizen Affairs
192	Aichi	23224	Chita-shi	84,364	city	2019/12/04	Environment and Economy Department, Environmental Policy Division	Env. Dept.
193	Aichi	23236	Miyoshi-shi	61,952	city	2021/04/12	Environment and Economy Department, Environment Division, Zero Carbon Promotion Office	Env. Dept.

194	Mie	24443	Odai-cho	8,668	town, village	2021/04/12	Living Environment Division	Citizen Affairs
195	Mie	24471	Taiki-cho	7,815	town, village	2020/12/01	Environment and Waterworks Division	Urban / Public Works
196	Mie	24472	Minamiise-cho	10,989	town, village	2021/04/12	Environment and Living Division	Citizen Affairs
197	Mie	24543	Kihoku-cho	14,604	town, village	2021/12/17		Not Specified
198	Shiga	25206	Kusatsu-shi	143,913	city	2020/08/31	Environment and Economy Department, Global Warming Countermeasures Office	Env. Dept.
199	Shiga	25211	Konan-shi	54,460	city	2019/05/11	Environment and Economy Department, Environmental Policy Division, Regional Energy Office	Env. Dept.
200	Kyōto	26100	Kyoto-shi	1,463,723	designated city	2021/02/26	Environmental Policy Bureau, Global Warming Countermeasures Office	Env. Dept.
201	Kyōto	26201	Fukuchiyama-shi	77,306	city	2021/09/06	Industry Policy Department, Energy and Environment Strategy Division	Industry / Economy
202	Kyōto	26203	Ayabe-shi	31,846	city	2020/06/04	Citizen Environment Department, Environmental Planning Division	Citizen Affairs
203	Kyōto	26205	Miyazu-shi	16,758	city	2021/02/15	Citizen Environment Division	Citizen Affairs
204	Kyōto	26206	Kameoka-shi	86,174	city	2020/03/04		Not Specified
205	Kyōto	26465	Yosano-cho	20,092	town, village	2020/12/09	Resident Environment Division	Citizen Affairs
206	Ōsaka	27100	Osaka-shi	2,752,412	designated city	2021/03/26	Environment Bureau, Environmental Measures Department, Environmental Policy Division	Env. Dept.
207	Ōsaka	27140	Sakai-shi	826,161	designated city	2021/07/19	Environment Bureau, Carbon Neutral Promotion Department, Environment and Energy Division	Env. Dept.
208	Ōsaka	27202	Kishiwada-shi	190,658	city	2021/02/10	Environmental Conservation Division	Env. Dept.
209	Ōsaka	27203	Toyonaka-shi	401,558	city	2021/02/10	Environmental Policy Division	Env. Dept.
210	Ōsaka	27205	Suita-shi	385,567	city	2020/06/17	Environmental Policy Office	Env. Dept.
211	Ōsaka	27206	Izumiotu-shi	74,412	city	2020/02/08	Urban Policy Department, Environment Division	Urban / Public Works
212	Ōsaka	27210	Hirakata-shi	397,289	city	2021/04/01	Environment Department, Environmental Policy Division	Env. Dept.
213	Ōsaka	27212	Yao-shi	264,642	city	2021/09/29	Environment Department, Environmental Conservation Division	Env. Dept.
214	Ōsaka	27213	Izumisano-shi	100,131	city	2021/03/08	Living Industry Department, Environmental Hygiene Division	Industry / Economy
215	Ōsaka	27216	Kawachinagano-shi	101,692	city	2021/04/01	Environment and Economy Department, Environmental Policy Division	Env. Dept.
216	Ōsaka	27219	Izumi-shi	184,495	city	2020/05/16	Environment and Industry Department, Environmental Conservation Division	Env. Dept.
217	Ōsaka	27227	Higashiosaka-shi	493,940	city	2021/03/04	Environment Department, Environmental Planning Division	Env. Dept.
218	Ōsaka	27322	Nose-cho	9,079	town, village	2021/07/20	General Affairs Division	General Affairs
219	Ōsaka	27381	Taishi-cho	13,009	town, village	2021/02/22	Community Development Promotion Department, Environment and Agriculture-Forestry Division	Planning / Policy
220	Hyōgo	28201	Himeji-shi	530,495	city	2021/06/05	Environmental Policy Office	Env. Dept.
221	Hyōgo	28202	Amagasaki-shi	459,593	city	2020/03/23	Economic and Environment Bureau, Environment Department, Environmental Creation Division	Env. Dept.
222	Hyōgo	28203	Akashi-shi	303,601	city	2021/02/19	Environmental Creation Division	Env. Dept.
223	Hyōgo	28204	Nishinomiya-shi	485,587	city	2021/06/01	Environmental Learning City Promotion Division	Env. Dept.
224	Hyōgo	28206	Ashiya-shi	93,922	city	2021/02/26	Citizen Life Department, Environment Division	Citizen Affairs
225	Hyōgo	28209	Toyooka-shi	77,489	city	2021/07/27	Living Environment Division, Global Warming Prevention Office	Citizen Affairs
226	Hyōgo	28214	Takarazuka-shi	226,432	city	2021/07/30	Regional Energy Division	Env. Dept.
227	Hyōgo	28216	Takasago-shi	87,722	city	2021/06/03	Living Environment Department, Environmental Policy Division	Citizen Affairs

228	Hyōgo	28219	Sanda-shi	109,238	city	2022/01/05	Environmental Creation Division	Env. Dept.
229	Hyōgo	28221	Tambasayama-shi	39,611	city	2021/08/11	Environment and Future Department, Rural Environment Division	Env. Dept.
230	Hyōgo	28226	Awaji-shi	41,967	city	2019/11/25	Planning and Information Department, Community Development Policy Division	Planning / Policy
231	Nara	29209	Ikoma-shi	116,675	city	2021/03/03	SDGs Promotion Division	Planning / Policy
232	Nara	29343	Sango-cho	23,219	town, village	2021/07/28	General Affairs Department, Community Development Promotion Division	General Affairs
233	Nara	29363	Tawaramoto-cho	31,177	town, village	2021/11/29	Environment Future Promotion Division	Env. Dept.
234	Wakayama	30392	Hidakagawa-cho	9,219	town, village	2021/02/24	Planning and Policy Division	Planning / Policy
235	Tottori	31204	Sakaiminato-shi	32,740	city	2019/12/20	Environmental Hygiene Division	Env. Dept.
236	Tottori	31372	Hokuei-cho	14,228	town, village	2020/12/07	Environment and Energy Division	Env. Dept.
237	Shimane	32201	Matsue-shi	203,616	city	2021/05/27	Environment and Energy Department, Environment and Energy Division	Env. Dept.
238	Shimane	32203	Izumo-shi	172,775	city	2021/03/15	Environmental Policy Division, Zero Carbon Promotion Office	Env. Dept.
239	Shimane	32448	Misato-cho	4,355	town, village	2021/02/02	Planning Promotion Division	Planning / Policy
240	Okayama	33100	Okayama-shi	724,691	designated city	2021/06/07	Environment Bureau, Environment Department, Environmental Conservation Division	Env. Dept.
241	Okayama	33202	Kurashiki-shi	474,592	city	2021/02/02		Not Specified
242	Okayama	33203	Tsuyama-shi	99,937	city	2021/02/02	Environment and Living Division	Citizen Affairs
243	Okayama	33204	Tamano-shi	56,531	city	2020/03/17	Environmental Conservation Division	Env. Dept.
244	Okayama	33214	Maniwa-shi	42,725	city	2021/02/02	Living Environment Department, Environment Division	Citizen Affairs
245	Okayama	33663	Kumenan-cho	4,530	town, village	2021/02/02	Tax and Resident Division	Citizen Affairs
246	Okayama	33666	Misaki-cho	13,053	town, village	2020/12/08	Resident Tax Division	Citizen Affairs
247	Hiroshima	34100	Hiroshima-shi	1,200,754	designated city	2020/11/24	Environment Bureau, Global Warming Countermeasures Division	Env. Dept.
248	Hiroshima	34205	Onomichi-shi	131,170	city	2021/03/25	Environmental Policy Division	Env. Dept.
249	Hiroshima	34431	Osakikamijima-cho	7,158	town, village	2021/05/24	Planning Division	Planning / Policy
250	Yamaguchi	35201	Shimonoseki-shi	255,051	city	2021/12/27	Environment Department, Environmental Policy Division	Env. Dept.
251	Yamaguchi	35203	Yamaguchi-shi	193,966	city	2021/08/30	Environment Department, Environmental Policy Division	Env. Dept.
252	Tokushima	36204	Anan-shi	69,470	city	2021/12/22	Planning Department, Zero Carbon Promotion Office	Planning / Policy
253	Tokushima	36208	Miyoshi-shi	23,605	city	2021/10/01	Environment Division	Env. Dept.
254	Tokushima	36402	Kitajima-cho	22,745	town, village	2020/12/03	Community Future Division	Planning / Policy
255	Kagawa	37201	Takamatsu-shi	417,496	city	2021/03/02	Environment Bureau, Zero Carbon City Promotion Division	Env. Dept.
256	Kagawa	37202	Marugame-shi	109,513	city	2021/03/01	Citizen Life Department, Living Environment Division	Citizen Affairs
257	Kagawa	37207	Higashikagawa-shi	28,279	city	2021/09/10	Environmental Hygiene Division	Env. Dept.
258	Kagawa	37386	Utazu-cho	18,699	town, village	2021/06/01	Resident Life Division	Citizen Affairs
259	Ehime	38205	Niihama-shi	115,938	city	2021/05/14	Carbon Neutral Promotion Office	Env. Dept.
260	Kōchi	39201	Kochi-shi	326,545	city	2021/04/26	New Energy and Environmental Policy Division	Env. Dept.
261	Kōchi	39204	Nankoku-shi	46,664	city	2021/04/06	Environment Division	Env. Dept.

262	Kōchi	39208	Sukumo-shi	19,033	city	2021/03/22		Not Specified
263	Kōchi	39210	Shimanto-shi	32,694	city	2021/11/15	Shimanto River and Environment Section	Env. Dept.
264	Kōchi	39341	Motoyama-cho	3,261	town, village	2021/03/15	Policy Planning Division	Planning / Policy
265	Fukuoka	40203	Kurume-shi	303,316	city	2021/02/22	Environment Department, Environmental Policy Division	Env. Dept.
266	Fukuoka	40215	Nakama-shi	40,362	city	2022/01/25	Environment and Waterworks Department, Environmental Conservation Division	Urban / Public Works
267	Fukuoka	40219	Onojo-shi	102,085	city	2021/02/22	Environment and Economy Department, Circular Society Promotion Division	Env. Dept.
268	Fukuoka	40220	Munakata-shi	97,095	city	2021/10/08	Decarbonized Society Promotion Office	Env. Dept.
269	Fukuoka	40221	Dazaifu-shi	73,164	city	2021/06/25	Environment Division	Env. Dept.
270	Fukuoka	40223	Koga-shi	58,786	city	2021/11/30	Citizen Department, Environment Division	Citizen Affairs
271	Fukuoka	40225	Ukiha-shi	27,981	city	2022/01/31	Citizen Life Division	Citizen Affairs
272	Fukuoka	40229	Miyama-shi	35,861	city	2021/08/26	Environmental Hygiene Division	Env. Dept.
273	Fukuoka	40342	Sasaguri-machi	31,209	town, village	2021/09/08	Urban Development Division	Urban / Public Works
274	Fukuoka	40401	Kotake-machi	7,151	town, village	2021/06/24	Agriculture and Environment Division	Industry / Economy
275	Fukuoka	40522	Oki-machi	13,820	town, village	2019/12/12	Community Development Division, Environment Group	Planning / Policy
276	Fukuoka	40642	Yoshitomi-machi	6,536	town, village	2022/01/17	Resident Division	Citizen Affairs
277	Nagasaki	42212	Saikai-shi	26,275	city	2021/06/11	New Industry Promotion Division	Industry / Economy
278	Nagasaki	42214	Minamishimabara-shi	42,330	city	2021/12/15	Environment and Waterworks Department, Environment Division	Env. Dept.
279	Nagasaki	42307	Nagayo-cho	40,780	town, village	2021/03/17	Resident Environment Division	Citizen Affairs
280	Kumamoto	43100	Kumamoto-shi	738,865	designated city	2020/01/18	Environment Bureau, Environment Promotion Department, Environmental Policy Division, Global Warming and Energy Measures Office	Env. Dept.
281	Kumamoto	43204	Arao-shi	50,832	city	2021/03/17	Citizen Environment Department, Environmental Conservation Division	Citizen Affairs
282	Kumamoto	43210	Kikuchi-shi	46,416	city	2020/01/18	Environment Division	Env. Dept.
283	Kumamoto	43211	Uto-shi	36,122	city	2020/01/18	Environment and Transportation Division	Urban / Public Works
284	Kumamoto	43213	Uki-shi	57,032	city	2020/01/18	Health and Sanitation Department, Sanitation and Environment Division	Env. Dept.
285	Kumamoto	43216	Koshi-shi	61,772	city	2020/01/18	Environmental Hygiene Division	Env. Dept.
286	Kumamoto	43348	Misato-machi	9,392	town, village	2020/01/18	Waterworks and Sanitation Division	Urban / Public Works
287	Kumamoto	43428	Takamori-machi	5,789	town, village	2020/01/18	Living Environment Division	Citizen Affairs
288	Kumamoto	43433	Minamiaso-mura	9,836	town, village	2020/01/18	Water and Environment Division	Env. Dept.
289	Kumamoto	43442	Kashima-machi	9,547	town, village	2020/01/18	Urban Planning Division	Urban / Public Works
290	Kumamoto	43443	Mashiki-machi	32,510	town, village	2020/01/18		Not Specified
291	Kumamoto	43447	Yamato-cho	13,503	town, village	2020/01/18	Environment and Waterworks Division	Env. Dept.
292	Kumamoto	43514	Asagiri-cho	14,676	town, village	2022/01/24	Planning and Policy Division	Planning / Policy
293	Ōita	44201	Oita-shi	475,614	city	2021/04/01	Environmental Measures Division	Env. Dept.

294	Ōita	44204	Hita-shi	62,657	city	2021/08/01	Citizen Environment Department, Environment Division	Citizen Affairs
295	Ōita	44211	Usa-shi	52,771	city	2021/06/01	Citizen Life Department, Living Environment Division	Citizen Affairs
296	Miyazaki	45201	Miyazaki-shi	401,339	city	2021/08/30	Environment Department, Environmental Policy Division	Env. Dept.
297	Miyazaki	45207	Kushima-shi	16,822	city	2020/12/11	Citizen Life Division	Citizen Affairs
298	Miyazaki	45406	Tsuno-cho	9,906	town, village	2021/09/13	Resident Division	Citizen Affairs
299	Miyazaki	45443	Gokase-cho	3,472	town, village	2021/10/01	Planning Division	Planning / Policy
300	Kagoshima	46201	Kagoshima-shi	593,128	city	2019/12/25	Environmental Policy Division	Env. Dept.
301	Kagoshima	46210	Ibusuki-shi	39,011	city	2021/04/09	Citizen Life Department, Environmental Policy Division	Citizen Affairs
302	Kagoshima	46215	Satsumasendai-shi	92,403	city	2021/06/08	Citizen Safety Department, Environment Division	Citizen Affairs
303	Kagoshima	46216	Hioki-shi	47,153	city	2021/09/30	Citizen Welfare Department, Citizen Life Division	Citizen Affairs
304	Kagoshima	46404	Nagashima-cho	9,705	town, village	2021/09/06	Nursing Care and Environment Division	Welfare / Social
305	Kagoshima	46490	Kinko-cho	6,944	town, village	2021/07/14	Industry and Construction Division	Urban / Public Works
306	Kagoshima	46491	Minamiosumi-cho	6,481	town, village	2021/07/14	Planning Division	Planning / Policy
307	Kagoshima	46533	Wadomari-cho	6,246	town, village	2022/01/07	Planning Division	Planning / Policy
308	Okinawa	47211	Okinawa-shi	142,752	city	2021/07/19	Environment Division	Env. Dept.
309	Okinawa	47361	Kumejima-cho	7,192	town, village	2021/01/22	Project Promotion Division	Planning / Policy

Source: Compiled by the author based on the official list of Zero-Carbon Cities (MOE, 2025) and 2020 population census of Japan.

Appendix C. Correlation Analysis on the Survey Responses

Notes:

- Correlation analysis was conducted on the Likert-scale response data of the survey (i.e., evaluation of factor importance between 1 and 5)
- The analysis was performed using software MAXQDA Analytics Pro (Stats module)
- Method: Spearman's rank correlation, with two-tailed p-value
- With excluded "I don't know" replies, the number of valid responses per pair of tested items hovers between 276 (min) and 305 (max)

$p < 0.3$ - weakly or non-significantly correlated

$p = 0.3-0.4$ - moderately-weakly correlated

$p = 0.4-0.5$ - moderately correlated

$p > 0.5$ - moderately-strongly or strongly correlated

	A	B	C	D	E
	MBE item 1 / MBE item 2	M1.1. Cost savings and financial benefits	M1.2. Local revitalization / Green Growth	M1.3. Improving local energy conditions	M2. Residents' livability and health
1					
2	M1.1. Cost savings and financial benefits		0.323 (p=0.0000) N=303	0.254 (p=0.0000) N=302	0.249 (p=0.0000) N=304
3	M1.2. Local revitalization / Green Growth	0.323 (p=0.0000) N=303		0.484 (p=0.0000) N=303	0.315 (p=0.0000) N=304
4	M1.3. Improving local energy conditions	0.254 (p=0.0000) N=302	0.484 (p=0.0000) N=303		0.315 (p=0.0000) N=303
5	M2. Residents' livability and health	0.249 (p=0.0000) N=304	0.315 (p=0.0000) N=304	0.315 (p=0.0000) N=303	
6	M3. Strengthening ties and gaining assistance from the national government	0.086 (p=0.1380) N=298	0.333 (p=0.0000) N=298	0.252 (p=0.0000) N=299	0.236 (p=0.0000) N=300
7	M4.1. Green city brand/identity	0.153 (p=0.0078) N=302	0.380 (p=0.0000) N=301	0.365 (p=0.0000) N=301	0.293 (p=0.0000) N=303
8	M4.2. Trend-setting and elevating municipal leadership	0.095 (p=0.1013) N=300	0.242 (p=0.0000) N=300	0.267 (p=0.0000) N=301	0.350 (p=0.0000) N=302
9	M5. Ensuring safety and resilience	0.089 (p=0.1244) N=301	0.224 (p=0.0001) N=301	0.370 (p=0.0000) N=302	0.341 (p=0.0000) N=303
10	M6. Aligning with global norms and contributing to global betterment	0.127 (p=0.0278) N=298	0.236 (p=0.0000) N=298	0.228 (p=0.0001) N=298	0.390 (p=0.0000) N=300
11	B1.1. Limited authority and influence of the dedicated municipal climate agency	0.112 (p=0.0513) N=301	0.017 (p=0.7695) N=301	0.085 (p=0.1390) N=301	0.121 (p=0.0353) N=303
12	E1.1. Sufficient authority and influence of the dedicated climate agency	0.103 (p=0.0746) N=303	0.124 (p=0.0306) N=303	0.187 (p=0.0011) N=303	0.049 (p=0.3950) N=306
13	B1.2. Limited municipal autonomy over key policy areas and infrastructure that have strong GHG implications	0.057 (p=0.3263) N=300	0.085 (p=0.1399) N=300	0.077 (p=0.1819) N=300	0.059 (p=0.3091) N=302
14	E1.2. Sufficient municipal autonomy and jurisdiction over key urban policy areas and infrastructure	0.102 (p=0.0792) N=295	0.171 (p=0.0033) N=295	0.127 (p=0.0286) N=295	0.099 (p=0.0884) N=298
15	B1.3. Inadequate legal/regulatory frameworks	-0.003 (p=0.9553) N=291	0.035 (p=0.5489) N=291	0.094 (p=0.1100) N=291	0.161 (p=0.0055) N=294
16	E1.3. Supportive legal context with adequate frameworks and mandates	0.191 (p=0.0008) N=302	0.121 (p=0.0358) N=302	0.131 (p=0.0225) N=301	0.144 (p=0.0117) N=304
17	B1.4. Constrained municipal budgets (i.e., limited own revenue or national transfers, fiscal stress)	0.125 (p=0.0303) N=300	0.084 (p=0.1489) N=300	0.059 (p=0.3109) N=300	0.121 (p=0.0359) N=302
18	E1.4. Adequate municipal budgets	0.157 (p=0.0064) N=302	0.139 (p=0.0154) N=302	0.183 (p=0.0014) N=302	0.145 (p=0.0112) N=304
19	B1.5. Limited accessibility to funding from external sources	0.158 (p=0.0068) N=292	0.168 (p=0.0041) N=292	0.073 (p=0.2128) N=293	0.097 (p=0.0972) N=295
20	E1.5. Accessibility to funding from external sources	0.137 (p=0.0174) N=300	0.185 (p=0.0013) N=300	0.202 (p=0.0004) N=301	0.104 (p=0.0708) N=303
21	B1.6. High upfront costs of climate measures	0.158 (p=0.0064) N=297	0.145 (p=0.0123) N=297	0.116 (p=0.0462) N=297	0.125 (p=0.0312) N=299
22	E1.6. Benefits, synergies, and links with other goals (e.g., SDGs) are maximized, offsetting policy costs	0.258 (p=0.0000) N=296	0.158 (p=0.0062) N=297	0.198 (p=0.0006) N=298	0.235 (p=0.0000) N=299
23	B1.7. Lack of staff (or staff-time) allocated to climate-related tasks in local administration	0.035 (p=0.5478) N=302	-0.000 (p=0.9934) N=302	0.130 (p=0.0236) N=302	0.042 (p=0.4689) N=304
24	E1.7. Enough staff dedicated to climate-related tasks within the local administration	0.042 (p=0.4679) N=301	0.031 (p=0.5923) N=301	0.167 (p=0.0037) N=301	0.077 (p=0.1808) N=303
25	B1.8. Lack of access to technological options and skilled workforce in the local area	0.017 (p=0.7695) N=289	0.149 (p=0.0113) N=289	0.130 (p=0.0275) N=289	0.103 (p=0.0781) N=291
26	E1.8. Local access to low-carbon solutions (e.g., technology and workforce)	0.059 (p=0.3111) N=296	0.064 (p=0.2704) N=296	0.147 (p=0.0113) N=296	0.060 (p=0.3030) N=299
27	B2.1. Lack of specialized knowledge and expertise among local administration staff	0.086 (p=0.1378) N=302	0.084 (p=0.1443) N=302	0.116 (p=0.0441) N=302	0.038 (p=0.5135) N=304
28	E2.1. Adequate climate governance expertise among local administration staff and policymakers	0.112 (p=0.0540) N=294	0.226 (p=0.0001) N=294	0.258 (p=0.0000) N=295	0.186 (p=0.0013) N=296
29	B2.2. Limited access to reliable and locally relevant data necessary for climate action	0.031 (p=0.5905) N=299	0.209 (p=0.0003) N=299	0.123 (p=0.0332) N=299	0.067 (p=0.2471) N=301
30	E2.2. Access to reliable and locally relevant data	0.191 (p=0.0009) N=299	0.207 (p=0.0003) N=299	0.262 (p=0.0000) N=299	0.172 (p=0.0027) N=301
31	B2.3. Lack of methods, tools and best practices for creating climate policy-relevant information and assessments	0.014 (p=0.8062) N=301	0.112 (p=0.0517) N=301	0.135 (p=0.0189) N=301	0.087 (p=0.1289) N=303
32	E2.3. Having access to technical instruments for generating climate policy-relevant information and assessments	0.061 (p=0.2955) N=299	0.092 (p=0.1128) N=299	0.141 (p=0.0144) N=299	0.056 (p=0.3298) N=301
33	B3.1. Rigid administrative work culture averse to innovation, risk-taking	-0.008 (p=0.8880) N=299	-0.019 (p=0.7395) N=299	0.053 (p=0.3630) N=299	0.114 (p=0.0474) N=301
34	E3.1. Municipal staff are stimulated, empowered, and actively encouraged to engage in climate work	0.161 (p=0.0051) N=300	0.242 (p=0.0000) N=301	0.205 (p=0.0004) N=300	0.198 (p=0.0005) N=302
35	B3.2. Insufficient inter-departmental collaboration and coordination on climate policy in the local administration	0.018 (p=0.7588) N=299	0.079 (p=0.1752) N=299	0.093 (p=0.1102) N=299	0.047 (p=0.4123) N=302
36	E3.2. Effective cross-sectoral coordination and cooperation on climate policy among local administration agencies	0.251 (p=0.0000) N=303	0.190 (p=0.0009) N=303	0.226 (p=0.0001) N=303	0.145 (p=0.0112) N=305
37	B3.3. Limited inter-municipal cooperation and coordination with neighboring and other peer local authorities	0.002 (p=0.9750) N=295	0.109 (p=0.0606) N=295	0.046 (p=0.4314) N=296	0.079 (p=0.1753) N=297
38	E3.3. Strong external horizontal cooperation and partnership with neighboring and other peer municipalities	0.088 (p=0.1317) N=295	0.176 (p=0.0024) N=295	0.212 (p=0.0002) N=295	0.209 (p=0.0003) N=298
39	B3.4. Insufficient vertical coordination and cooperation between national, regional, and local authorities	0.001 (p=0.9838) N=298	0.013 (p=0.8259) N=298	-0.009 (p=0.8806) N=297	0.014 (p=0.8125) N=300
40	E3.4. Effective vertical climate governance across all government levels (national, regional, local)	0.154 (p=0.0074) N=301	0.161 (p=0.0052) N=302	0.172 (p=0.0028) N=301	0.228 (p=0.0001) N=303
41	B3.5. Difficulty in engaging and forming partnerships with local stakeholders for co-creation and joint implementation	0.025 (p=0.6641) N=295	0.135 (p=0.0206) N=295	0.092 (p=0.1140) N=295	0.017 (p=0.7743) N=297
42	E3.5. Strong stakeholder engagement (e.g., businesses, residents) in local climate action	0.183 (p=0.0015) N=298	0.288 (p=0.0000) N=298	0.303 (p=0.0000) N=298	0.184 (p=0.0013) N=300
43	B4.1. Lack of climate policy champions	0.066 (p=0.2601) N=293	-0.020 (p=0.7378) N=294	-0.082 (p=0.1602) N=295	0.059 (p=0.3122) N=295
44	E4.1. Presence of dedicated climate policy champions among local leaders	0.195 (p=0.0007) N=296	0.205 (p=0.0004) N=296	0.254 (p=0.0000) N=296	0.209 (p=0.0003) N=299
45	B4.2. Lack of clear vision, guidance, and leadership by the upper echelons of government (high-level political context)	0.012 (p=0.8378) N=296	-0.024 (p=0.6798) N=296	-0.031 (p=0.5984) N=297	0.004 (p=0.9412) N=298
46	E4.2. Strong vision, enthusiasm and leadership by the upper echelons of government (national, provincial)	0.159 (p=0.0060) N=297	0.214 (p=0.0002) N=297	0.164 (p=0.0047) N=297	0.140 (p=0.0153) N=299
47	B4.3. Low continuity and priority of climate action on municipal agenda	-0.069 (p=0.2492) N=284	0.025 (p=0.6785) N=284	-0.040 (p=0.5042) N=286	0.163 (p=0.0058) N=287
48	E4.3. High priority, continuity, and favorability toward environmental action on local agenda	0.168 (p=0.0040) N=291	0.176 (p=0.0026) N=291	0.195 (p=0.0008) N=293	0.226 (p=0.0001) N=293
49	B4.4. Low public interest, involvement, and demand for climate policy	0.008 (p=0.8848) N=294	-0.015 (p=0.7978) N=295	0.117 (p=0.0438) N=295	0.011 (p=0.8485) N=296
50	E4.4. Citizens exhibiting high interest and demand for climate policy	0.117 (p=0.0435) N=298	0.295 (p=0.0000) N=298	0.247 (p=0.0000) N=297	0.213 (p=0.0002) N=300
51	B4.5. Weak problem perception or skepticism within the city hall	0.143 (p=0.0131) N=299	0.024 (p=0.6744) N=299	0.076 (p=0.1893) N=300	-0.067 (p=0.2492) N=301

	F	G	H	I	J	K	L	M
1	M3. Strengthening ties and gaining assistance from the national government	M4.1. Green city brand/identity	M4.2. Trend-setting and elevating municipal leadership	M5. Ensuring safety and resilience	M6. Aligning with global norms and contributing to global betterment	B1.1. Limited authority and influence of the dedicated municipal climate agency	E1.1. Sufficient authority and influence of the dedicated climate agency	B1.2. Limited municipal autonomy over key policy areas and infrastructure that have strong GHG implications
2	0.086 (p=0.1380) N=298	0.153 (p=0.0078) N=302	0.095 (p=0.1013) N=300	0.089 (p=0.1244) N=301	0.127 (p=0.0276) N=298	0.112 (p=0.0513) N=301	0.103 (p=0.0746) N=303	0.057 (p=0.3263) N=300
3	0.333 (p=0.0000) N=298	0.380 (p=0.0000) N=301	0.242 (p=0.0000) N=300	0.224 (p=0.0001) N=301	0.236 (p=0.0000) N=298	0.017 (p=0.7695) N=301	0.124 (p=0.0306) N=303	0.085 (p=0.1399) N=300
4	0.252 (p=0.0000) N=299	0.365 (p=0.0000) N=301	0.267 (p=0.0000) N=301	0.370 (p=0.0000) N=302	0.228 (p=0.0001) N=298	0.065 (p=0.1390) N=301	0.187 (p=0.0011) N=303	0.077 (p=0.1819) N=300
5	0.236 (p=0.0000) N=300	0.293 (p=0.0000) N=303	0.350 (p=0.0000) N=302	0.341 (p=0.0000) N=303	0.390 (p=0.0000) N=300	0.121 (p=0.0353) N=303	0.049 (p=0.3950) N=306	0.059 (p=0.3091) N=302
6		0.432 (p=0.0000) N=299	0.409 (p=0.0000) N=298	0.128 (p=0.0275) N=299	0.337 (p=0.0000) N=295	0.007 (p=0.9005) N=298	0.013 (p=0.8241) N=300	0.087 (p=0.1329) N=298
7	0.432 (p=0.0000) N=299		0.486 (p=0.0000) N=301	0.325 (p=0.0000) N=301	0.421 (p=0.0000) N=298	-0.023 (p=0.6858) N=300	0.032 (p=0.5754) N=302	0.042 (p=0.4742) N=299
8	0.409 (p=0.0000) N=298	0.486 (p=0.0000) N=301		0.325 (p=0.0000) N=300	0.481 (p=0.0000) N=297	0.047 (p=0.4178) N=300	-0.057 (p=0.3281) N=301	0.022 (p=0.7091) N=299
9	0.128 (p=0.0275) N=299	0.325 (p=0.0000) N=301	0.325 (p=0.0000) N=300		0.329 (p=0.0000) N=300	0.031 (p=0.5950) N=301	0.080 (p=0.1654) N=303	0.072 (p=0.2124) N=300
10	0.337 (p=0.0000) N=295	0.421 (p=0.0000) N=298	0.481 (p=0.0000) N=297	0.329 (p=0.0000) N=300		0.044 (p=0.4535) N=297	-0.010 (p=0.8674) N=299	0.062 (p=0.2880) N=297
11	0.007 (p=0.9005) N=298	-0.023 (p=0.6858) N=300	0.047 (p=0.4178) N=300	0.031 (p=0.5950) N=301	0.044 (p=0.4535) N=297		0.282 (p=0.0000) N=303	0.389 (p=0.0000) N=302
12	0.013 (p=0.8241) N=300	0.032 (p=0.5754) N=302	-0.057 (p=0.3281) N=301	0.080 (p=0.1654) N=303	-0.010 (p=0.8674) N=299	0.282 (p=0.0000) N=303		0.089 (p=0.1221) N=302
13	0.087 (p=0.1329) N=298	0.042 (p=0.4742) N=299	0.022 (p=0.7091) N=299	0.072 (p=0.2124) N=300	0.062 (p=0.2880) N=297	0.389 (p=0.0000) N=302	0.089 (p=0.1221) N=302	
14	0.127 (p=0.0294) N=293	0.117 (p=0.0446) N=294	0.104 (p=0.0768) N=293	0.161 (p=0.0056) N=295	0.139 (p=0.0181) N=291	0.186 (p=0.0014) N=295	0.317 (p=0.0000) N=299	0.277 (p=0.0000) N=295
15	0.090 (p=0.1283) N=289	-0.029 (p=0.6253) N=290	0.096 (p=0.1042) N=290	0.016 (p=0.7890) N=291	0.059 (p=0.3151) N=288	0.371 (p=0.0000) N=294	0.076 (p=0.1914) N=294	0.558 (p=0.0000) N=294
16	0.110 (p=0.0574) N=298	0.137 (p=0.0175) N=301	0.114 (p=0.0478) N=301	0.028 (p=0.6273) N=301	0.092 (p=0.1139) N=298	0.183 (p=0.0014) N=302	0.252 (p=0.0000) N=303	0.195 (p=0.0007) N=300
17	0.121 (p=0.0365) N=297	-0.036 (p=0.5357) N=299	0.043 (p=0.4581) N=298	0.131 (p=0.0231) N=300	-0.008 (p=0.8900) N=296	0.266 (p=0.0000) N=302	0.210 (p=0.0002) N=302	0.177 (p=0.0021) N=300
18	0.074 (p=0.2033) N=299	0.003 (p=0.9574) N=301	-0.070 (p=0.2298) N=300	0.056 (p=0.3362) N=302	-0.029 (p=0.6130) N=298	0.176 (p=0.0021) N=303	0.331 (p=0.0000) N=305	0.055 (p=0.3417) N=301
19	0.156 (p=0.0079) N=290	-0.020 (p=0.7275) N=292	0.088 (p=0.1363) N=291	0.068 (p=0.2459) N=293	0.034 (p=0.5601) N=289	0.280 (p=0.0000) N=294	0.134 (p=0.0217) N=295	0.184 (p=0.0016) N=292
20	0.096 (p=0.0974) N=298	0.012 (p=0.8373) N=300	-0.025 (p=0.6712) N=299	0.106 (p=0.0674) N=301	-0.017 (p=0.7721) N=297	0.120 (p=0.0368) N=301	0.284 (p=0.0000) N=304	0.059 (p=0.3122) N=299
21	0.113 (p=0.0532) N=294	0.070 (p=0.2271) N=296	0.072 (p=0.2163) N=296	0.134 (p=0.0208) N=297	0.024 (p=0.6772) N=293	0.306 (p=0.0000) N=300	0.198 (p=0.0006) N=299	0.272 (p=0.0000) N=298
22	0.115 (p=0.0486) N=295	0.079 (p=0.1751) N=296	0.083 (p=0.1574) N=295	0.129 (p=0.0266) N=297	0.128 (p=0.0267) N=293	0.069 (p=0.1261) N=297	0.237 (p=0.0000) N=299	-0.002 (p=0.9789) N=295
23	0.006 (p=0.9165) N=299	-0.075 (p=0.1962) N=301	0.015 (p=0.7944) N=300	0.076 (p=0.1891) N=302	-0.010 (p=0.8654) N=298	0.308 (p=0.0000) N=303	0.316 (p=0.0000) N=304	0.156 (p=0.0067) N=302
24	0.080 (p=0.1671) N=299	-0.031 (p=0.5979) N=300	-0.015 (p=0.7959) N=299	0.052 (p=0.3703) N=301	-0.010 (p=0.8637) N=297	0.255 (p=0.0000) N=301	0.506 (p=0.0000) N=304	0.067 (p=0.2464) N=300
25	0.099 (p=0.0948) N=288	0.066 (p=0.2604) N=289	0.100 (p=0.0885) N=289	0.051 (p=0.3885) N=289	0.005 (p=0.9300) N=285	0.320 (p=0.0000) N=290	0.141 (p=0.0157) N=291	0.152 (p=0.0097) N=289
26	0.093 (p=0.1129) N=294	0.046 (p=0.4352) N=295	0.052 (p=0.3729) N=294	0.104 (p=0.0731) N=297	0.052 (p=0.3749) N=293	0.220 (p=0.0001) N=296	0.364 (p=0.0000) N=300	0.057 (p=0.3287) N=295
27	0.003 (p=0.9651) N=300	0.039 (p=0.5038) N=301	-0.035 (p=0.5495) N=300	0.128 (p=0.0254) N=303	-0.052 (p=0.3718) N=299	0.279 (p=0.0000) N=302	0.199 (p=0.0005) N=304	0.185 (p=0.0013) N=301
28	0.159 (p=0.0062) N=294	0.184 (p=0.0015) N=295	0.107 (p=0.0664) N=296	0.169 (p=0.0036) N=296	0.107 (p=0.0674) N=292	0.137 (p=0.0182) N=296	0.306 (p=0.0000) N=296	0.097 (p=0.0977) N=293
29	0.045 (p=0.4411) N=298	0.073 (p=0.2058) N=299	0.056 (p=0.3341) N=298	-0.021 (p=0.7188) N=300	0.085 (p=0.1459) N=296	0.259 (p=0.0000) N=299	0.149 (p=0.0099) N=301	0.281 (p=0.0000) N=299
30	0.099 (p=0.0890) N=297	0.182 (p=0.0016) N=298	0.121 (p=0.0379) N=297	0.111 (p=0.0540) N=300	0.187 (p=0.0012) N=296	0.214 (p=0.0002) N=300	0.308 (p=0.0000) N=301	0.212 (p=0.0002) N=299
31	0.018 (p=0.7551) N=299	0.040 (p=0.4883) N=301	-0.003 (p=0.9594) N=300	0.040 (p=0.4904) N=301	-0.010 (p=0.8644) N=297	0.194 (p=0.0007) N=301	0.137 (p=0.0170) N=303	0.233 (p=0.0000) N=300
32	0.030 (p=0.6120) N=297	0.100 (p=0.0849) N=298	0.013 (p=0.8290) N=297	0.144 (p=0.0125) N=299	0.070 (p=0.2285) N=295	0.220 (p=0.0001) N=300	0.335 (p=0.0000) N=301	0.224 (p=0.0001) N=298
33	-0.039 (p=0.5040) N=298	-0.032 (p=0.5799) N=298	-0.000 (p=0.9947) N=298	0.032 (p=0.5844) N=299	-0.026 (p=0.6613) N=295	0.324 (p=0.0000) N=301	0.123 (p=0.0324) N=301	0.230 (p=0.0001) N=301
34	0.124 (p=0.0321) N=298	0.234 (p=0.0000) N=299	0.137 (p=0.0178) N=298	0.239 (p=0.0000) N=300	0.104 (p=0.0747) N=296	0.249 (p=0.0000) N=302	0.320 (p=0.0000) N=302	0.141 (p=0.0149) N=299
35	-0.085 (p=0.1447) N=297	-0.058 (p=0.3159) N=298	-0.024 (p=0.6817) N=297	0.062 (p=0.2850) N=299	-0.053 (p=0.3689) N=295	0.454 (p=0.0000) N=300	0.231 (p=0.0000) N=302	0.241 (p=0.0000) N=299
36	-0.013 (p=0.8280) N=300	0.143 (p=0.0130) N=302	0.042 (p=0.4630) N=301	0.255 (p=0.0000) N=303	0.076 (p=0.1927) N=299	0.271 (p=0.0000) N=304	0.368 (p=0.0000) N=305	0.140 (p=0.0150) N=302
37	0.085 (p=0.1466) N=295	0.014 (p=0.8129) N=295	0.046 (p=0.4367) N=294	-0.020 (p=0.7380) N=296	0.074 (p=0.2094) N=292	0.199 (p=0.0006) N=296	0.014 (p=0.8110) N=297	0.240 (p=0.0000) N=297
38	0.220 (p=0.0001) N=292	0.206 (p=0.0004) N=295	0.167 (p=0.0040) N=294	0.127 (p=0.0297) N=295	0.125 (p=0.0332) N=292	0.080 (p=0.1695) N=296	0.151 (p=0.0091) N=298	0.076 (p=0.1941) N=293
39	-0.047 (p=0.4165) N=295	0.008 (p=0.8969) N=297	0.062 (p=0.2858) N=297	-0.043 (p=0.4582) N=298	0.036 (p=0.5383) N=295	0.154 (p=0.0076) N=299	-0.019 (p=0.7388) N=299	0.262 (p=0.0000) N=298
40	0.144 (p=0.0127) N=298	0.211 (p=0.0002) N=300	0.107 (p=0.0635) N=299	0.134 (p=0.0199) N=300	0.146 (p=0.0120) N=297	0.147 (p=0.0109) N=301	0.144 (p=0.0125) N=302	0.175 (p=0.0024) N=299
41	-0.051 (p=0.3850) N=294	-0.017 (p=0.7717) N=296	0.062 (p=0.2869) N=296	0.108 (p=0.0637) N=296	0.002 (p=0.9709) N=293	0.300 (p=0.0000) N=296	0.141 (p=0.0152) N=296	0.206 (p=0.0004) N=295
42	0.150 (p=0.0100) N=296	0.265 (p=0.0000) N=297	0.155 (p=0.0074) N=296	0.218 (p=0.0001) N=298	0.189 (p=0.0012) N=294	0.042 (p=0.4661) N=299	0.226 (p=0.0001) N=300	0.168 (p=0.0036) N=297
43	-0.060 (p=0.3018) N=294	-0.168 (p=0.0039) N=293	-0.016 (p=0.7878) N=293	-0.044 (p=0.4584) N=294	-0.157 (p=0.0073) N=290	0.373 (p=0.0000) N=294	0.149 (p=0.0105) N=295	0.227 (p=0.0001) N=294
44	0.099 (p=0.0916) N=294	0.206 (p=0.0004) N=295	0.202 (p=0.0005) N=294	0.147 (p=0.0115) N=296	0.137 (p=0.0193) N=292	0.278 (p=0.0000) N=297	0.353 (p=0.0000) N=299	0.162 (p=0.0053) N=295
45	0.050 (p=0.3930) N=294	0.053 (p=0.3613) N=296	0.113 (p=0.0527) N=295	-0.007 (p=0.9062) N=297	-0.017 (p=0.7785) N=293	0.165 (p=0.0042) N=298	0.001 (p=0.9875) N=298	0.234 (p=0.0000) N=296
46	0.117 (p=0.0452) N=294	0.198 (p=0.0006) N=296	0.174 (p=0.0027) N=296	0.054 (p=0.3566) N=296	0.112 (p=0.0549) N=293	0.192 (p=0.0009) N=297	0.243 (p=0.0000) N=298	0.177 (p=0.0023) N=295
47	-0.065 (p=0.2709) N=285	-0.062 (p=0.2985) N=284	0.009 (p=0.8836) N=285	0.039 (p=0.5116) N=285	-0.054 (p=0.3647) N=281	0.290 (p=0.0000) N=288	0.000 (p=0.9980) N=287	0.222 (p=0.0001) N=287
48	0.058 (p=0.3212) N=290	0.190 (p=0.0011) N=291	0.153 (p=0.0088) N=291	0.088 (p=0.1308) N=293	0.088 (p=0.1376) N=289	0.215 (p=0.0002) N=292	0.273 (p=0.0000) N=294	0.105 (p=0.0744) N=290
49	0.019 (p=0.7479) N=294	0.101 (p=0.0824) N=296	0.034 (p=0.5667) N=294	0.159 (p=0.0064) N=295	-0.014 (p=0.8117) N=291	0.257 (p=0.0000) N=295	0.184 (p=0.0014) N=296	0.196 (p=0.0007) N=295
50	0.159 (p=0.0063) N=295	0.317 (p=0.0000) N=297	0.150 (p=0.0097) N=296	0.205 (p=0.0004) N=297	0.223 (p=0.0001) N=294	0.128 (p=0.0285) N=299	0.267 (p=0.0000) N=299	0.116 (p=0.0469) N=296
51	-0.057 (p=0.3279) N=298	-0.010 (p=0.8655) N=299	-0.046 (p=0.4291) N=298	0.005 (p=0.9377) N=300	-0.033 (p=0.5667) N=296	0.384 (p=0.0000) N=301	0.212 (p=0.0002) N=301	0.218 (p=0.0001) N=299

	N	O	P	Q	R	S	T	U
1	E1.2. Sufficient municipal autonomy and jurisdiction over key urban policy areas and infrastructure	B1.3. Inadequate legal/regulatory frameworks	E1.3. Supportive legal context with adequate frameworks and mandates	B1.4. Constrained municipal budgets (i.e., limited own revenue or national transfers, fiscal stress)	E1.4. Adequate municipal budgets	B1.5. Limited accessibility to funding from external sources	E1.5. Accessibility to funding from external sources	B1.6. High upfront costs of climate measures
2	0.102 (p=0.0792) N=295	-0.003 (p=0.9553) N=291	0.191 (p=0.0008) N=302	0.125 (p=0.0303) N=300	0.157 (p=0.0064) N=302	0.158 (p=0.0068) N=292	0.137 (p=0.0174) N=300	0.158 (p=0.0064) N=297
3	0.171 (p=0.0033) N=295	0.035 (p=0.5489) N=291	0.121 (p=0.0358) N=302	0.084 (p=0.1489) N=300	0.139 (p=0.0154) N=302	0.168 (p=0.0041) N=292	0.185 (p=0.0013) N=300	0.145 (p=0.0123) N=297
4	0.127 (p=0.0286) N=295	0.094 (p=0.1100) N=291	0.131 (p=0.0225) N=301	0.059 (p=0.3109) N=300	0.183 (p=0.0014) N=302	0.073 (p=0.2128) N=293	0.202 (p=0.0004) N=301	0.116 (p=0.0462) N=297
5	0.099 (p=0.0884) N=298	0.161 (p=0.0055) N=294	0.144 (p=0.0117) N=304	0.121 (p=0.0359) N=302	0.145 (p=0.0112) N=304	0.097 (p=0.0972) N=295	0.104 (p=0.0708) N=303	0.125 (p=0.0312) N=299
6	0.127 (p=0.0294) N=293	0.090 (p=0.1283) N=289	0.110 (p=0.0574) N=298	0.121 (p=0.0365) N=297	0.074 (p=0.2033) N=299	0.156 (p=0.0079) N=290	0.096 (p=0.0974) N=298	0.113 (p=0.0532) N=294
7	0.117 (p=0.0446) N=294	-0.029 (p=0.6253) N=290	0.137 (p=0.0175) N=301	-0.036 (p=0.5357) N=299	0.003 (p=0.9574) N=301	-0.020 (p=0.7275) N=292	0.012 (p=0.8373) N=300	0.070 (p=0.2271) N=296
8	0.104 (p=0.0768) N=293	0.096 (p=0.1042) N=290	0.114 (p=0.0478) N=301	0.043 (p=0.4581) N=298	-0.070 (p=0.2298) N=300	0.088 (p=0.1363) N=291	-0.025 (p=0.6712) N=299	0.072 (p=0.2163) N=296
9	0.161 (p=0.0056) N=295	0.016 (p=0.7890) N=291	0.028 (p=0.6273) N=301	0.131 (p=0.0231) N=300	0.056 (p=0.3362) N=302	0.068 (p=0.2459) N=293	0.106 (p=0.0674) N=301	0.134 (p=0.0208) N=297
10	0.139 (p=0.0181) N=291	0.059 (p=0.3151) N=288	0.092 (p=0.1139) N=298	-0.008 (p=0.8900) N=296	-0.029 (p=0.6130) N=298	0.034 (p=0.5601) N=289	-0.017 (p=0.7721) N=297	0.024 (p=0.6772) N=293
11	0.186 (p=0.0014) N=295	0.371 (p=0.0000) N=294	0.183 (p=0.0014) N=302	0.266 (p=0.0000) N=302	0.176 (p=0.0021) N=303	0.280 (p=0.0000) N=294	0.120 (p=0.0388) N=301	0.306 (p=0.0000) N=300
12	0.317 (p=0.0000) N=299	0.076 (p=0.1914) N=294	0.252 (p=0.0000) N=303	0.210 (p=0.0002) N=302	0.331 (p=0.0000) N=305	0.134 (p=0.0217) N=295	0.284 (p=0.0000) N=304	0.198 (p=0.0006) N=299
13	0.277 (p=0.0000) N=295	0.558 (p=0.0000) N=294	0.195 (p=0.0007) N=300	0.177 (p=0.0021) N=300	0.055 (p=0.3417) N=301	0.184 (p=0.0016) N=292	0.059 (p=0.3122) N=299	0.272 (p=0.0000) N=298
14		0.237 (p=0.0000) N=288	0.383 (p=0.0000) N=296	0.111 (p=0.0560) N=295	0.212 (p=0.0002) N=297	0.098 (p=0.0977) N=289	0.198 (p=0.0006) N=296	0.221 (p=0.0001) N=292
15	0.237 (p=0.0000) N=288		0.354 (p=0.0000) N=292	0.230 (p=0.0001) N=292	0.153 (p=0.0007) N=293	0.218 (p=0.0002) N=287	0.101 (p=0.0848) N=292	0.220 (p=0.0002) N=291
16	0.383 (p=0.0000) N=296	0.354 (p=0.0000) N=292		0.164 (p=0.0043) N=301	0.309 (p=0.0000) N=303	0.215 (p=0.0002) N=293	0.281 (p=0.0000) N=301	0.315 (p=0.0000) N=298
17	0.111 (p=0.0560) N=295	0.230 (p=0.0001) N=292	0.164 (p=0.0043) N=301		0.518 (p=0.0000) N=302	0.667 (p=0.0000) N=295	0.444 (p=0.0000) N=300	0.467 (p=0.0000) N=300
18	0.212 (p=0.0002) N=297	0.153 (p=0.0087) N=293	0.309 (p=0.0000) N=303	0.518 (p=0.0000) N=302		0.398 (p=0.0000) N=295	0.736 (p=0.0000) N=304	0.296 (p=0.0000) N=299
19	0.098 (p=0.0977) N=289	0.218 (p=0.0002) N=287	0.215 (p=0.0002) N=293	0.667 (p=0.0000) N=295	0.398 (p=0.0000) N=295		0.483 (p=0.0000) N=295	0.429 (p=0.0000) N=293
20	0.198 (p=0.0006) N=296	0.101 (p=0.0848) N=292	0.281 (p=0.0000) N=301	0.444 (p=0.0000) N=300	0.736 (p=0.0000) N=304	0.483 (p=0.0000) N=295		0.315 (p=0.0000) N=297
21	0.221 (p=0.0001) N=292	0.220 (p=0.0002) N=291	0.315 (p=0.0000) N=298	0.467 (p=0.0000) N=300	0.296 (p=0.0000) N=299	0.429 (p=0.0000) N=293	0.315 (p=0.0000) N=297	
22	0.149 (p=0.0107) N=293	0.150 (p=0.0109) N=288	0.215 (p=0.0002) N=298	0.131 (p=0.0239) N=296	0.242 (p=0.0000) N=298	0.128 (p=0.0287) N=290	0.239 (p=0.0000) N=298	0.267 (p=0.0000) N=294
23	0.120 (p=0.0393) N=296	0.111 (p=0.0584) N=293	0.090 (p=0.1190) N=302	0.340 (p=0.0000) N=303	0.264 (p=0.0000) N=303	0.281 (p=0.0000) N=295	0.254 (p=0.0000) N=301	0.237 (p=0.0000) N=300
24	0.190 (p=0.0010) N=296	0.140 (p=0.0171) N=291	0.248 (p=0.0000) N=301	0.218 (p=0.0001) N=300	0.450 (p=0.0000) N=303	0.133 (p=0.0233) N=292	0.390 (p=0.0000) N=301	0.169 (p=0.0034) N=297
25	0.153 (p=0.0100) N=283	0.279 (p=0.0000) N=280	0.144 (p=0.0142) N=290	0.290 (p=0.0000) N=290	0.142 (p=0.0153) N=290	0.370 (p=0.0000) N=283	0.185 (p=0.0016) N=288	0.289 (p=0.0000) N=287
26	0.322 (p=0.0000) N=293	0.137 (p=0.0205) N=287	0.274 (p=0.0000) N=297	0.214 (p=0.0002) N=295	0.319 (p=0.0000) N=298	0.197 (p=0.0008) N=288	0.299 (p=0.0000) N=297	0.273 (p=0.0000) N=292
27	0.182 (p=0.0016) N=296	0.299 (p=0.0000) N=292	0.200 (p=0.0005) N=292	0.167 (p=0.0036) N=301	0.093 (p=0.1045) N=303	0.236 (p=0.0000) N=293	0.093 (p=0.1065) N=301	0.238 (p=0.0000) N=298
28	0.200 (p=0.0006) N=288	0.225 (p=0.0001) N=285	0.303 (p=0.0000) N=295	0.090 (p=0.1222) N=294	0.184 (p=0.0014) N=296	0.086 (p=0.1444) N=287	0.158 (p=0.0064) N=295	0.155 (p=0.0082) N=291
29	0.204 (p=0.0004) N=294	0.267 (p=0.0000) N=292	0.106 (p=0.0664) N=299	0.153 (p=0.0080) N=298	0.042 (p=0.4692) N=300	0.263 (p=0.0000) N=291	0.028 (p=0.6322) N=298	0.186 (p=0.0013) N=296
30	0.211 (p=0.0003) N=294	0.244 (p=0.0000) N=291	0.200 (p=0.0005) N=300	0.203 (p=0.0004) N=299	0.223 (p=0.0001) N=301	0.207 (p=0.0004) N=291	0.178 (p=0.0020) N=299	0.117 (p=0.0443) N=296
31	0.231 (p=0.0001) N=295	0.322 (p=0.0000) N=292	0.139 (p=0.0157) N=301	0.153 (p=0.0080) N=300	0.121 (p=0.0357) N=302	0.217 (p=0.0002) N=292	0.108 (p=0.0629) N=300	0.193 (p=0.0008) N=297
32	0.243 (p=0.0000) N=293	0.268 (p=0.0000) N=290	0.215 (p=0.0002) N=300	0.112 (p=0.0534) N=299	0.089 (p=0.1236) N=301	0.110 (p=0.0598) N=291	0.134 (p=0.0200) N=299	0.171 (p=0.0032) N=296
33	0.149 (p=0.0106) N=295	0.359 (p=0.0000) N=293	0.150 (p=0.0093) N=299	0.269 (p=0.0000) N=299	0.200 (p=0.0005) N=300	0.229 (p=0.0001) N=292	0.115 (p=0.0480) N=298	0.212 (p=0.0002) N=298
34	0.236 (p=0.0000) N=294	0.129 (p=0.0272) N=291	0.266 (p=0.0000) N=301	0.168 (p=0.0035) N=300	0.248 (p=0.0000) N=302	0.180 (p=0.0020) N=292	0.189 (p=0.0010) N=300	0.201 (p=0.0005) N=297
35	0.192 (p=0.0009) N=295	0.183 (p=0.0017) N=292	0.086 (p=0.1357) N=299	0.195 (p=0.0007) N=299	0.197 (p=0.0006) N=300	0.136 (p=0.0195) N=293	0.084 (p=0.1460) N=299	0.283 (p=0.0000) N=297
36	0.264 (p=0.0000) N=297	0.104 (p=0.0749) N=294	0.293 (p=0.0000) N=304	0.198 (p=0.0005) N=303	0.308 (p=0.0000) N=305	0.094 (p=0.1079) N=295	0.236 (p=0.0000) N=303	0.315 (p=0.0000) N=300
37	0.131 (p=0.0256) N=290	0.229 (p=0.0001) N=288	0.047 (p=0.4226) N=295	0.180 (p=0.0019) N=295	0.072 (p=0.2190) N=296	0.194 (p=0.0009) N=290	0.071 (p=0.2262) N=295	0.153 (p=0.0088) N=294
38	0.279 (p=0.0000) N=291	0.225 (p=0.0001) N=286	0.231 (p=0.0001) N=296	0.077 (p=0.1866) N=294	0.102 (p=0.0783) N=297	0.091 (p=0.1244) N=288	0.154 (p=0.0079) N=297	0.186 (p=0.0015) N=291
39	0.107 (p=0.0677) N=292	0.325 (p=0.0000) N=290	0.227 (p=0.0001) N=298	0.256 (p=0.0000) N=298	0.117 (p=0.0431) N=298	0.253 (p=0.0000) N=291	0.082 (p=0.1573) N=296	0.193 (p=0.0008) N=297
40	0.275 (p=0.0000) N=294	0.215 (p=0.0002) N=291	0.425 (p=0.0000) N=302	0.219 (p=0.0001) N=300	0.345 (p=0.0000) N=302	0.228 (p=0.0001) N=292	0.297 (p=0.0000) N=300	0.267 (p=0.0000) N=297
41	0.159 (p=0.0070) N=288	0.193 (p=0.0010) N=287	0.122 (p=0.0369) N=295	0.305 (p=0.0000) N=294	0.219 (p=0.0001) N=295	0.308 (p=0.0000) N=289	0.192 (p=0.0009) N=294	0.260 (p=0.0000) N=293
42	0.256 (p=0.0000) N=292	0.189 (p=0.0012) N=291	0.279 (p=0.0000) N=299	0.131 (p=0.0237) N=298	0.240 (p=0.0000) N=300	0.158 (p=0.0069) N=291	0.190 (p=0.0010) N=298	0.164 (p=0.0047) N=296
43	0.182 (p=0.0020) N=288	0.260 (p=0.0000) N=286	0.121 (p=0.0382) N=293	0.284 (p=0.0000) N=294	0.205 (p=0.0004) N=294	0.296 (p=0.0000) N=288	0.151 (p=0.0095) N=293	0.246 (p=0.0000) N=292
44	0.174 (p=0.0028) N=292	0.154 (p=0.0088) N=288	0.283 (p=0.0000) N=297	0.158 (p=0.0065) N=296	0.237 (p=0.0000) N=298	0.127 (p=0.0308) N=289	0.190 (p=0.0010) N=297	0.299 (p=0.0000) N=293
45	0.171 (p=0.0035) N=291	0.343 (p=0.0000) N=288	0.289 (p=0.0000) N=296	0.187 (p=0.0012) N=297	0.158 (p=0.0062) N=297	0.295 (p=0.0000) N=291	0.152 (p=0.0088) N=296	0.167 (p=0.0041) N=296
46	0.211 (p=0.0003) N=291	0.201 (p=0.0006) N=287	0.472 (p=0.0000) N=298	0.187 (p=0.0012) N=296	0.282 (p=0.0000) N=298	0.203 (p=0.0005) N=288	0.253 (p=0.0000) N=296	0.235 (p=0.0000) N=293
47	0.213 (p=0.0003) N=282	0.324 (p=0.0000) N=279	0.181 (p=0.0021) N=285	0.215 (p=0.0002) N=287	0.138 (p=0.0192) N=286	0.190 (p=0.0014) N=281	0.105 (p=0.0749) N=286	0.218 (p=0.0002) N=286
48	0.294 (p=0.0000) N=287	0.192 (p=0.0012) N=283	0.329 (p=0.0000) N=292	0.187 (p=0.0014) N=291	0.285 (p=0.0000) N=294	0.141 (p=0.0173) N=285	0.214 (p=0.0002) N=293	0.268 (p=0.0000) N=289
49	0.150 (p=0.0109) N=289	0.203 (p=0.0005) N=286	0.125 (p=0.0326) N=294	0.168 (p=0.0039) N=294	0.193 (p=0.0008) N=295	0.197 (p=0.0008) N=287	0.180 (p=0.0019) N=294	0.226 (p=0.0001) N=291
50	0.243 (p=0.0000) N=292	0.151 (p=0.0101) N=288	0.215 (p=0.0002) N=299	0.059 (p=0.3139) N=297	0.217 (p=0.0002) N=299	0.021 (p=0.7275) N=289	0.120 (p=0.0393) N=297	0.191 (p=0.0010) N=294
51	0.204 (p=0.0004) N=293	0.235 (p=0.0000) N=292	0.109 (p=0.0598) N=300	0.187 (p=0.0011) N=300	0.141 (p=0.0145) N=301	0.242 (p=0.0000) N=294	0.095 (p=0.1006) N=300	0.304 (p=0.0000) N=298

	V	W	X	Y	Z	AA	AB	AC
1	E1.6. Benefits, synergies, and links with other goals (e.g., SDGs) are maximized, offsetting policy costs	1.7. Lack of staff (or staff-time) allocated to climate-related tasks in local administration	1.7. Enough staff dedicated to climate-related tasks within the local administration	B1.8. Lack of access to technological options and skilled workforce in the local area	E1.8. Local access to low-carbon solutions (e.g., technology and workforce)	B2.1. Lack of specialized knowledge and expertise among local administration staff	E2.1. Adequate climate governance expertise among local administration staff and policymakers	B2.2. Limited access to reliable and locally relevant data necessary for climate action
2	0.258 (p=0.0000) N=296	0.035 (p=0.5478) N=302	0.042 (p=0.4679) N=301	0.017 (p=0.7695) N=289	0.059 (p=0.3111) N=296	0.086 (p=0.1378) N=302	0.112 (p=0.0540) N=294	0.031 (p=0.5905) N=299
3	0.158 (p=0.0062) N=297	-0.000 (p=0.9934) N=302	0.031 (p=0.5923) N=301	0.149 (p=0.0113) N=289	0.064 (p=0.2704) N=296	0.084 (p=0.1443) N=302	0.226 (p=0.0001) N=294	0.209 (p=0.0003) N=299
4	0.198 (p=0.0006) N=298	0.130 (p=0.0236) N=302	0.167 (p=0.0037) N=301	0.130 (p=0.0275) N=289	0.147 (p=0.0113) N=296	0.116 (p=0.0441) N=302	0.258 (p=0.0000) N=295	0.123 (p=0.0332) N=299
5	0.235 (p=0.0000) N=299	0.042 (p=0.4689) N=304	0.077 (p=0.1808) N=303	0.103 (p=0.0781) N=291	0.060 (p=0.3030) N=299	0.038 (p=0.5135) N=304	0.186 (p=0.0013) N=296	0.067 (p=0.2471) N=301
6	0.115 (p=0.0486) N=295	0.006 (p=0.9165) N=299	0.080 (p=0.1671) N=299	0.099 (p=0.0948) N=288	0.093 (p=0.1129) N=294	0.003 (p=0.9651) N=300	0.159 (p=0.0062) N=294	0.045 (p=0.4411) N=298
7	0.079 (p=0.1751) N=296	-0.075 (p=0.1962) N=301	-0.031 (p=0.5979) N=300	0.066 (p=0.2604) N=289	0.046 (p=0.4352) N=295	0.039 (p=0.5038) N=301	0.184 (p=0.0015) N=295	0.073 (p=0.2058) N=299
8	0.083 (p=0.1574) N=295	0.015 (p=0.7944) N=300	-0.015 (p=0.7959) N=299	0.100 (p=0.0885) N=289	0.052 (p=0.3729) N=294	-0.035 (p=0.5495) N=300	0.107 (p=0.0664) N=294	0.056 (p=0.3341) N=298
9	0.129 (p=0.0266) N=297	0.076 (p=0.1891) N=302	0.052 (p=0.3703) N=301	0.051 (p=0.3885) N=289	0.104 (p=0.0731) N=297	0.128 (p=0.0254) N=303	0.169 (p=0.0036) N=296	-0.021 (p=0.7188) N=300
10	0.128 (p=0.0287) N=293	-0.010 (p=0.8654) N=298	-0.010 (p=0.8637) N=297	0.005 (p=0.9300) N=285	0.052 (p=0.3749) N=293	-0.052 (p=0.3718) N=299	0.107 (p=0.0674) N=292	0.085 (p=0.1459) N=296
11	0.089 (p=0.1261) N=297	0.308 (p=0.0000) N=303	0.255 (p=0.0000) N=301	0.320 (p=0.0000) N=290	0.220 (p=0.0001) N=296	0.279 (p=0.0000) N=302	0.137 (p=0.0182) N=296	0.259 (p=0.0000) N=299
12	0.237 (p=0.0000) N=299	0.316 (p=0.0000) N=304	0.506 (p=0.0000) N=304	0.141 (p=0.0157) N=291	0.364 (p=0.0000) N=300	0.199 (p=0.0005) N=304	0.306 (p=0.0000) N=296	0.149 (p=0.0099) N=301
13	-0.002 (p=0.9789) N=295	0.156 (p=0.0067) N=302	0.067 (p=0.2464) N=300	0.152 (p=0.0097) N=289	0.057 (p=0.3287) N=295	0.185 (p=0.0013) N=301	0.097 (p=0.0977) N=293	0.281 (p=0.0000) N=299
14	0.149 (p=0.0107) N=293	0.120 (p=0.0393) N=296	0.190 (p=0.0010) N=296	0.153 (p=0.0100) N=283	0.322 (p=0.0000) N=293	0.182 (p=0.0016) N=296	0.200 (p=0.0006) N=288	0.204 (p=0.0004) N=294
15	0.150 (p=0.0109) N=288	0.111 (p=0.0584) N=293	0.140 (p=0.0171) N=291	0.279 (p=0.0000) N=280	0.137 (p=0.0205) N=287	0.299 (p=0.0000) N=292	0.225 (p=0.0001) N=285	0.267 (p=0.0000) N=292
16	0.215 (p=0.0002) N=298	0.090 (p=0.1190) N=302	0.248 (p=0.0000) N=301	0.144 (p=0.0142) N=290	0.274 (p=0.0000) N=297	0.200 (p=0.0005) N=302	0.303 (p=0.0000) N=295	0.106 (p=0.0664) N=299
17	0.131 (p=0.0239) N=296	0.340 (p=0.0000) N=303	0.218 (p=0.0001) N=300	0.290 (p=0.0000) N=290	0.214 (p=0.0002) N=295	0.167 (p=0.0036) N=301	0.090 (p=0.1222) N=294	0.153 (p=0.0080) N=298
18	0.242 (p=0.0000) N=298	0.264 (p=0.0000) N=303	0.450 (p=0.0000) N=303	0.142 (p=0.0153) N=290	0.319 (p=0.0000) N=298	0.093 (p=0.1045) N=303	0.184 (p=0.0014) N=296	0.042 (p=0.4692) N=300
19	0.128 (p=0.0287) N=290	0.281 (p=0.0000) N=295	0.133 (p=0.0233) N=292	0.370 (p=0.0000) N=283	0.197 (p=0.0008) N=288	0.236 (p=0.0000) N=293	0.086 (p=0.1444) N=287	0.263 (p=0.0000) N=291
20	0.239 (p=0.0000) N=298	0.254 (p=0.0000) N=301	0.390 (p=0.0000) N=301	0.185 (p=0.0016) N=288	0.299 (p=0.0000) N=297	0.093 (p=0.1065) N=301	0.158 (p=0.0064) N=295	0.028 (p=0.6322) N=298
21	0.267 (p=0.0000) N=294	0.237 (p=0.0000) N=300	0.169 (p=0.0034) N=297	0.289 (p=0.0000) N=287	0.273 (p=0.0000) N=292	0.238 (p=0.0000) N=298	0.155 (p=0.0082) N=291	0.186 (p=0.0013) N=296
22		0.049 (p=0.4048) N=297	0.176 (p=0.0023) N=297	0.119 (p=0.0457) N=284	0.259 (p=0.0000) N=294	0.171 (p=0.0031) N=297	0.414 (p=0.0000) N=292	0.113 (p=0.0522) N=294
23	0.049 (p=0.4048) N=297		0.594 (p=0.0000) N=302	0.466 (p=0.0000) N=292	0.332 (p=0.0000) N=297	0.271 (p=0.0000) N=303	0.166 (p=0.0043) N=295	0.201 (p=0.0005) N=300
24	0.176 (p=0.0023) N=297	0.594 (p=0.0000) N=302		0.284 (p=0.0000) N=289	0.548 (p=0.0000) N=298	0.240 (p=0.0000) N=302	0.280 (p=0.0000) N=295	0.118 (p=0.0409) N=299
25	0.119 (p=0.0457) N=284	0.466 (p=0.0000) N=292	0.284 (p=0.0000) N=289		0.355 (p=0.0000) N=286	0.273 (p=0.0000) N=290	0.245 (p=0.0000) N=283	0.238 (p=0.0000) N=288
26	0.259 (p=0.0000) N=294	0.332 (p=0.0000) N=297	0.548 (p=0.0000) N=298	0.355 (p=0.0000) N=286		0.264 (p=0.0000) N=297	0.365 (p=0.0000) N=291	0.159 (p=0.0064) N=294
27	0.171 (p=0.0031) N=297	0.271 (p=0.0000) N=303	0.240 (p=0.0000) N=302	0.273 (p=0.0000) N=290	0.284 (p=0.0000) N=297		0.340 (p=0.0000) N=296	0.352 (p=0.0000) N=302
28	0.414 (p=0.0000) N=292	0.166 (p=0.0043) N=295	0.280 (p=0.0000) N=295	0.245 (p=0.0000) N=283	0.365 (p=0.0000) N=291			0.192 (p=0.0009) N=294
29	0.113 (p=0.0522) N=294	0.201 (p=0.0005) N=300	0.118 (p=0.0409) N=299	0.238 (p=0.0000) N=288	0.159 (p=0.0064) N=294	0.352 (p=0.0000) N=302	0.192 (p=0.0009) N=294	
30	0.328 (p=0.0000) N=295	0.169 (p=0.0034) N=300	0.222 (p=0.0001) N=299	0.210 (p=0.0003) N=287	0.227 (p=0.0001) N=295	0.229 (p=0.0001) N=301	0.420 (p=0.0000) N=297	0.406 (p=0.0000) N=299
31	0.082 (p=0.1578) N=296	0.211 (p=0.0002) N=302	0.200 (p=0.0005) N=301	0.250 (p=0.0000) N=291	0.297 (p=0.0000) N=296	0.388 (p=0.0000) N=303	0.215 (p=0.0002) N=295	0.542 (p=0.0000) N=302
32	0.228 (p=0.0001) N=296	0.122 (p=0.0347) N=300	0.196 (p=0.0006) N=300	0.176 (p=0.0028) N=287	0.326 (p=0.0000) N=296	0.226 (p=0.0001) N=300	0.384 (p=0.0000) N=297	0.260 (p=0.0000) N=297
33	0.040 (p=0.4971) N=296	0.278 (p=0.0000) N=301	0.265 (p=0.0000) N=300	0.271 (p=0.0000) N=288	0.229 (p=0.0001) N=295	0.367 (p=0.0000) N=300	0.149 (p=0.0108) N=293	0.201 (p=0.0005) N=299
34	0.272 (p=0.0000) N=297	0.231 (p=0.0001) N=301	0.307 (p=0.0000) N=301	0.295 (p=0.0000) N=288	0.336 (p=0.0000) N=296	0.318 (p=0.0000) N=301	0.351 (p=0.0000) N=297	0.253 (p=0.0000) N=298
35	0.070 (p=0.2292) N=297	0.301 (p=0.0000) N=301	0.181 (p=0.0016) N=300	0.172 (p=0.0033) N=288	0.141 (p=0.0149) N=296	0.147 (p=0.0106) N=300	0.062 (p=0.2919) N=293	0.186 (p=0.0012) N=298
36	0.274 (p=0.0000) N=299	0.277 (p=0.0000) N=304	0.332 (p=0.0000) N=303	0.212 (p=0.0003) N=291	0.294 (p=0.0000) N=298	0.207 (p=0.0003) N=304	0.263 (p=0.0000) N=298	0.093 (p=0.1066) N=301
37	0.107 (p=0.0681) N=293	0.173 (p=0.0028) N=297	0.098 (p=0.0923) N=296	0.354 (p=0.0000) N=285	0.184 (p=0.0016) N=291	0.167 (p=0.0013) N=296	0.098 (p=0.0950) N=290	0.209 (p=0.0003) N=295
38	0.312 (p=0.0000) N=293	0.135 (p=0.0208) N=295	0.256 (p=0.0000) N=295	0.272 (p=0.0000) N=283	0.304 (p=0.0000) N=291	0.274 (p=0.0000) N=295	0.453 (p=0.0000) N=292	0.207 (p=0.0004) N=292
39	0.091 (p=0.1200) N=293	0.116 (p=0.0446) N=299	0.124 (p=0.0323) N=298	0.234 (p=0.0001) N=287	0.160 (p=0.0059) N=293	0.253 (p=0.0000) N=299	0.104 (p=0.0764) N=292	0.224 (p=0.0001) N=297
40	0.360 (p=0.0000) N=298	0.185 (p=0.0012) N=301	0.289 (p=0.0000) N=301	0.266 (p=0.0000) N=288	0.369 (p=0.0000) N=296	0.293 (p=0.0000) N=301	0.388 (p=0.0000) N=296	0.150 (p=0.0093) N=298
41	0.010 (p=0.8626) N=292	0.202 (p=0.0005) N=296	0.177 (p=0.0022) N=295	0.318 (p=0.0000) N=285	0.194 (p=0.0009) N=290	0.214 (p=0.0002) N=296	0.065 (p=0.2657) N=291	0.276 (p=0.0000) N=295
42	0.282 (p=0.0000) N=295	0.117 (p=0.0431) N=299	0.124 (p=0.0324) N=299	0.226 (p=0.0001) N=286	0.307 (p=0.0000) N=294	0.223 (p=0.0001) N=299	0.395 (p=0.0000) N=294	0.145 (p=0.0125) N=297
43	0.081 (p=0.1679) N=290	0.242 (p=0.0000) N=296	0.199 (p=0.0006) N=294	0.304 (p=0.0000) N=284	0.176 (p=0.0026) N=289	0.275 (p=0.0000) N=295	0.091 (p=0.1214) N=288	0.205 (p=0.0004) N=293
44	0.258 (p=0.0000) N=294	0.167 (p=0.0037) N=298	0.257 (p=0.0000) N=297	0.134 (p=0.0238) N=284	0.285 (p=0.0000) N=293	0.278 (p=0.0000) N=298	0.324 (p=0.0000) N=292	0.205 (p=0.0004) N=295
45	0.039 (p=0.5071) N=293	0.229 (p=0.0001) N=298	0.168 (p=0.0037) N=296	0.291 (p=0.0000) N=287	0.143 (p=0.0145) N=291	0.286 (p=0.0000) N=297	0.212 (p=0.0003) N=292	0.210 (p=0.0003) N=295
46	0.268 (p=0.0000) N=293	0.071 (p=0.2213) N=298	0.212 (p=0.0002) N=297	0.175 (p=0.0030) N=284	0.191 (p=0.0010) N=292	0.209 (p=0.0003) N=298	0.304 (p=0.0000) N=292	0.114 (p=0.0498) N=295
47	0.049 (p=0.4082) N=284	0.175 (p=0.0030) N=287	0.122 (p=0.0402) N=285	0.311 (p=0.0000) N=276	0.146 (p=0.0146) N=281	0.240 (p=0.0000) N=286	0.102 (p=0.0866) N=281	0.154 (p=0.0094) N=283
48	0.309 (p=0.0000) N=289	0.207 (p=0.0004) N=293	0.224 (p=0.0001) N=293	0.238 (p=0.0001) N=279	0.329 (p=0.0000) N=288	0.228 (p=0.0001) N=294	0.331 (p=0.0000) N=289	0.182 (p=0.0018) N=292
49	0.126 (p=0.0320) N=290	0.117 (p=0.0435) N=296	0.078 (p=0.1801) N=294	0.276 (p=0.0000) N=285	0.205 (p=0.0004) N=289	0.275 (p=0.0000) N=295	0.185 (p=0.0016) N=289	0.200 (p=0.0006) N=294
50	0.242 (p=0.0000) N=294	0.103 (p=0.0761) N=298	0.151 (p=0.0090) N=298	0.161 (p=0.0063) N=285	0.276 (p=0.0000) N=293	0.215 (p=0.0002) N=299	0.369 (p=0.0000) N=294	0.176 (p=0.0024) N=296
51	0.069 (p=0.2324) N=297	0.222 (p=0.0001) N=301	0.124 (p=0.0318) N=300	0.178 (p=0.0024) N=288	0.203 (p=0.0005) N=295	0.305 (p=0.0000) N=300	0.086 (p=0.1419) N=295	0.235 (p=0.0000) N=298

	AD	AE	AF	AG	AH	AI	AJ	AK
1	E2.2. Access to reliable and locally relevant data	B2.3. Lack of methods, tools and best practices for creating climate policy-relevant information and assessments	E2.3. Having access to technical instruments for generating climate policy-relevant information and assessments	B3.1. Rigid administrative work culture averse to innovation, risk-taking	E3.1. Municipal staff are stimulated, empowered, and actively encouraged to engage in climate work	B3.2. Insufficient inter-departmental collaboration and coordination on climate policy in the local administration	E3.2. Effective cross-sectoral coordination and cooperation on climate policy among local administration agencies	B3.3. Limited inter-municipal cooperation and coordination with neighboring and other peer local authorities
2	0.191 (p=0.0009) N=299	0.014 (p=0.8062) N=301	0.061 (p=0.2955) N=299	-0.008 (p=0.8880) N=299	0.161 (p=0.0051) N=300	0.018 (p=0.7588) N=299	0.251 (p=0.0000) N=303	0.002 (p=0.9750) N=295
3	0.207 (p=0.0003) N=299	0.112 (p=0.0517) N=301	0.092 (p=0.1128) N=299	-0.019 (p=0.7395) N=299	0.242 (p=0.0000) N=301	0.079 (p=0.1752) N=299	0.190 (p=0.0009) N=303	0.109 (p=0.0606) N=295
4	0.262 (p=0.0000) N=299	0.135 (p=0.0189) N=301	0.141 (p=0.0144) N=299	0.053 (p=0.3630) N=299	0.205 (p=0.0004) N=300	0.093 (p=0.1102) N=299	0.226 (p=0.0001) N=303	0.046 (p=0.4314) N=296
5	0.172 (p=0.0027) N=301	0.087 (p=0.1289) N=303	0.056 (p=0.3298) N=301	0.114 (p=0.0474) N=301	0.198 (p=0.0005) N=302	0.047 (p=0.4123) N=302	0.145 (p=0.0112) N=305	0.079 (p=0.1753) N=297
6	0.099 (p=0.0890) N=297	0.018 (p=0.7551) N=299	0.030 (p=0.6120) N=297	-0.039 (p=0.5040) N=298	0.124 (p=0.0321) N=298	-0.085 (p=0.1447) N=297	-0.013 (p=0.8280) N=300	0.085 (p=0.1466) N=295
7	0.182 (p=0.0016) N=298	0.040 (p=0.4863) N=301	0.100 (p=0.0849) N=298	-0.032 (p=0.5799) N=298	0.234 (p=0.0000) N=299	-0.058 (p=0.3159) N=298	0.143 (p=0.0130) N=302	0.014 (p=0.8129) N=295
8	0.121 (p=0.0379) N=297	-0.003 (p=0.9594) N=300	0.013 (p=0.8290) N=297	-0.000 (p=0.9947) N=298	0.137 (p=0.0178) N=298	-0.024 (p=0.6817) N=297	0.042 (p=0.4630) N=301	0.046 (p=0.4367) N=294
9	0.111 (p=0.0540) N=300	0.040 (p=0.4904) N=301	0.144 (p=0.0125) N=299	0.032 (p=0.5844) N=299	0.239 (p=0.0000) N=300	0.062 (p=0.2850) N=299	0.255 (p=0.0000) N=303	-0.020 (p=0.7380) N=296
10	0.187 (p=0.0012) N=296	-0.010 (p=0.8644) N=297	0.070 (p=0.2285) N=295	-0.026 (p=0.6613) N=295	0.104 (p=0.0747) N=296	-0.053 (p=0.3689) N=295	0.076 (p=0.1927) N=299	0.074 (p=0.2094) N=292
11	0.214 (p=0.0002) N=300	0.194 (p=0.0007) N=301	0.220 (p=0.0001) N=300	0.324 (p=0.0000) N=301	0.249 (p=0.0000) N=302	0.454 (p=0.0000) N=300	0.271 (p=0.0000) N=304	0.199 (p=0.0006) N=296
12	0.308 (p=0.0000) N=301	0.137 (p=0.0170) N=303	0.335 (p=0.0000) N=301	0.123 (p=0.0324) N=301	0.320 (p=0.0000) N=302	0.231 (p=0.0000) N=302	0.368 (p=0.0000) N=305	0.014 (p=0.8110) N=297
13	0.212 (p=0.0002) N=299	0.233 (p=0.0000) N=300	0.224 (p=0.0001) N=298	0.230 (p=0.0001) N=301	0.141 (p=0.0149) N=299	0.241 (p=0.0000) N=299	0.140 (p=0.0150) N=302	0.240 (p=0.0000) N=297
14	0.211 (p=0.0003) N=294	0.231 (p=0.0001) N=295	0.243 (p=0.0000) N=293	0.149 (p=0.0106) N=295	0.236 (p=0.0000) N=294	0.192 (p=0.0009) N=295	0.264 (p=0.0000) N=297	0.131 (p=0.0256) N=290
15	0.244 (p=0.0000) N=291	0.322 (p=0.0000) N=292	0.268 (p=0.0000) N=290	0.359 (p=0.0000) N=293	0.129 (p=0.0272) N=291	0.183 (p=0.0017) N=292	0.104 (p=0.0749) N=294	0.229 (p=0.0001) N=288
16	0.200 (p=0.0005) N=300	0.139 (p=0.0157) N=301	0.215 (p=0.0002) N=300	0.150 (p=0.0093) N=299	0.266 (p=0.0000) N=301	0.086 (p=0.1357) N=299	0.293 (p=0.0000) N=304	0.047 (p=0.4226) N=295
17	0.203 (p=0.0004) N=299	0.153 (p=0.0080) N=300	0.112 (p=0.0534) N=299	0.269 (p=0.0000) N=299	0.168 (p=0.0035) N=300	0.195 (p=0.0007) N=299	0.198 (p=0.0005) N=303	0.180 (p=0.0019) N=295
18	0.223 (p=0.0001) N=301	0.121 (p=0.0357) N=302	0.089 (p=0.1236) N=301	0.200 (p=0.0005) N=300	0.248 (p=0.0000) N=302	0.197 (p=0.0006) N=300	0.308 (p=0.0000) N=305	0.072 (p=0.2190) N=296
19	0.207 (p=0.0004) N=291	0.217 (p=0.0002) N=292	0.110 (p=0.0598) N=291	0.229 (p=0.0001) N=292	0.180 (p=0.0020) N=292	0.136 (p=0.0195) N=293	0.094 (p=0.1079) N=295	0.194 (p=0.0009) N=290
20	0.178 (p=0.0020) N=299	0.108 (p=0.0629) N=300	0.134 (p=0.0200) N=299	0.115 (p=0.0480) N=298	0.189 (p=0.0010) N=300	0.084 (p=0.1460) N=299	0.236 (p=0.0000) N=303	0.071 (p=0.2262) N=295
21	0.117 (p=0.0443) N=296	0.193 (p=0.0008) N=297	0.171 (p=0.0032) N=296	0.212 (p=0.0002) N=298	0.201 (p=0.0005) N=297	0.283 (p=0.0000) N=297	0.315 (p=0.0000) N=300	0.153 (p=0.0088) N=294
22	0.328 (p=0.0000) N=295	0.082 (p=0.1578) N=296	0.228 (p=0.0001) N=296	0.040 (p=0.4971) N=296	0.272 (p=0.0000) N=297	0.070 (p=0.2292) N=297	0.274 (p=0.0000) N=299	0.107 (p=0.0681) N=293
23	0.169 (p=0.0034) N=300	0.211 (p=0.0002) N=302	0.122 (p=0.0347) N=300	0.278 (p=0.0000) N=301	0.231 (p=0.0001) N=301	0.301 (p=0.0000) N=301	0.277 (p=0.0000) N=304	0.173 (p=0.0028) N=297
24	0.222 (p=0.0001) N=299	0.200 (p=0.0005) N=301	0.196 (p=0.0006) N=300	0.265 (p=0.0000) N=300	0.307 (p=0.0000) N=301	0.181 (p=0.0016) N=300	0.332 (p=0.0000) N=303	0.098 (p=0.0923) N=296
25	0.210 (p=0.0003) N=287	0.250 (p=0.0000) N=291	0.176 (p=0.0028) N=287	0.271 (p=0.0000) N=288	0.295 (p=0.0000) N=288	0.172 (p=0.0033) N=288	0.212 (p=0.0003) N=291	0.354 (p=0.0000) N=285
26	0.227 (p=0.0001) N=295	0.297 (p=0.0000) N=296	0.326 (p=0.0000) N=296	0.229 (p=0.0001) N=295	0.336 (p=0.0000) N=296	0.141 (p=0.0149) N=296	0.294 (p=0.0000) N=298	0.184 (p=0.0016) N=291
27	0.229 (p=0.0001) N=301	0.388 (p=0.0000) N=303	0.226 (p=0.0001) N=300	0.367 (p=0.0000) N=300	0.318 (p=0.0000) N=301	0.147 (p=0.0106) N=300	0.207 (p=0.0003) N=304	0.187 (p=0.0013) N=296
28	0.420 (p=0.0000) N=297	0.215 (p=0.0002) N=295	0.384 (p=0.0000) N=297	0.149 (p=0.0108) N=293	0.351 (p=0.0000) N=297	0.062 (p=0.2919) N=293	0.263 (p=0.0000) N=296	0.098 (p=0.0950) N=290
29	0.406 (p=0.0000) N=299	0.542 (p=0.0000) N=302	0.260 (p=0.0000) N=297	0.201 (p=0.0005) N=299	0.253 (p=0.0000) N=298	0.186 (p=0.0012) N=298	0.093 (p=0.1066) N=301	0.209 (p=0.0003) N=295
30		0.350 (p=0.0000) N=299	0.418 (p=0.0000) N=301	0.098 (p=0.0904) N=298	0.340 (p=0.0000) N=300	0.054 (p=0.3536) N=297	0.222 (p=0.0001) N=303	0.165 (p=0.0047) N=294
31	0.350 (p=0.0000) N=299		0.312 (p=0.0000) N=299	0.261 (p=0.0005) N=299	0.151 (p=0.0088) N=300	0.080 (p=0.1661) N=299	0.045 (p=0.4336) N=303	0.130 (p=0.0256) N=295
32	0.418 (p=0.0000) N=301	0.312 (p=0.0000) N=299		0.186 (p=0.0012) N=298	0.310 (p=0.0000) N=301	0.097 (p=0.0954) N=298	0.239 (p=0.0000) N=303	0.014 (p=0.8050) N=294
33	0.098 (p=0.0904) N=298	0.261 (p=0.0000) N=299	0.186 (p=0.0012) N=298		0.214 (p=0.0002) N=299	0.358 (p=0.0000) N=301	0.156 (p=0.0068) N=301	0.294 (p=0.0000) N=297
34	0.340 (p=0.0000) N=300	0.151 (p=0.0088) N=300	0.310 (p=0.0000) N=301	0.214 (p=0.0002) N=299		0.212 (p=0.0002) N=299	0.528 (p=0.0000) N=304	0.161 (p=0.0057) N=295
35	0.054 (p=0.3536) N=297	0.080 (p=0.1661) N=299	0.097 (p=0.0954) N=298	0.358 (p=0.0000) N=301	0.212 (p=0.0002) N=299		0.393 (p=0.0000) N=301	0.262 (p=0.0000) N=296
36	0.222 (p=0.0001) N=303	0.045 (p=0.4336) N=303	0.239 (p=0.0000) N=303	0.156 (p=0.0068) N=301	0.528 (p=0.0000) N=304	0.393 (p=0.0000) N=301		0.009 (p=0.8722) N=297
37	0.165 (p=0.0047) N=294	0.130 (p=0.0256) N=295	0.014 (p=0.8050) N=294	0.294 (p=0.0000) N=297	0.161 (p=0.0057) N=295	0.262 (p=0.0000) N=296	0.009 (p=0.8722) N=297	
38	0.314 (p=0.0000) N=295	0.194 (p=0.0008) N=294	0.390 (p=0.0000) N=295	0.174 (p=0.0028) N=293	0.422 (p=0.0000) N=296	0.077 (p=0.1908) N=294	0.275 (p=0.0000) N=298	0.190 (p=0.0012) N=290
39	0.167 (p=0.0039) N=296	0.220 (p=0.0001) N=297	0.058 (p=0.3163) N=296	0.276 (p=0.0000) N=299	0.118 (p=0.0430) N=297	0.268 (p=0.0000) N=298	0.106 (p=0.0660) N=299	0.472 (p=0.0000) N=295
40	0.305 (p=0.0000) N=300	0.187 (p=0.0011) N=300	0.288 (p=0.0000) N=301	0.203 (p=0.0004) N=299	0.385 (p=0.0000) N=302	0.159 (p=0.0058) N=299	0.400 (p=0.0000) N=304	0.181 (p=0.0018) N=295
41	0.201 (p=0.0005) N=293	0.215 (p=0.0002) N=295	0.189 (p=0.0011) N=293	0.358 (p=0.0000) N=296	0.212 (p=0.0003) N=294	0.389 (p=0.0000) N=295	0.125 (p=0.0317) N=296	0.345 (p=0.0000) N=292
42	0.363 (p=0.0000) N=298	0.185 (p=0.0013) N=298	0.334 (p=0.0000) N=299	0.122 (p=0.0350) N=298	0.367 (p=0.0000) N=300	0.109 (p=0.0602) N=298	0.411 (p=0.0000) N=302	0.127 (p=0.0297) N=294
43	0.111 (p=0.0574) N=292	0.143 (p=0.0143) N=293	0.066 (p=0.2611) N=292	0.358 (p=0.0000) N=295	0.225 (p=0.0001) N=294	0.343 (p=0.0000) N=294	0.133 (p=0.0221) N=295	0.272 (p=0.0000) N=292
44	0.224 (p=0.0001) N=296	0.173 (p=0.0028) N=297	0.209 (p=0.0003) N=297	0.143 (p=0.0140) N=295	0.317 (p=0.0000) N=298	0.236 (p=0.0000) N=296	0.425 (p=0.0000) N=300	0.029 (p=0.6202) N=291
45	0.171 (p=0.0033) N=295	0.221 (p=0.0001) N=296	0.094 (p=0.1059) N=295	0.386 (p=0.0000) N=296	0.150 (p=0.0098) N=296	0.215 (p=0.0002) N=296	0.038 (p=0.5167) N=298	0.349 (p=0.0000) N=295
46	0.235 (p=0.0000) N=296	0.050 (p=0.3880) N=297	0.149 (p=0.0103) N=297	0.029 (p=0.6187) N=295	0.311 (p=0.0000) N=298	0.049 (p=0.4040) N=295	0.334 (p=0.0000) N=300	0.094 (p=0.1093) N=291
47	0.042 (p=0.4773) N=284	0.156 (p=0.0086) N=284	0.121 (p=0.0411) N=284	0.378 (p=0.0000) N=286	0.122 (p=0.0393) N=286	0.376 (p=0.0000) N=285	0.106 (p=0.0722) N=287	0.230 (p=0.0001) N=285
48	0.240 (p=0.0000) N=292	0.200 (p=0.0006) N=292	0.204 (p=0.0005) N=292	0.118 (p=0.0448) N=291	0.350 (p=0.0000) N=293	0.209 (p=0.0003) N=291	0.402 (p=0.0000) N=295	0.147 (p=0.0127) N=288
49	0.141 (p=0.0154) N=293	0.158 (p=0.0066) N=295	0.136 (p=0.0200) N=292	0.252 (p=0.0000) N=294	0.266 (p=0.0000) N=294	0.309 (p=0.0000) N=293	0.211 (p=0.0003) N=296	0.143 (p=0.0149) N=291
50	0.316 (p=0.0000) N=297	0.139 (p=0.0165) N=298	0.289 (p=0.0000) N=298	0.054 (p=0.3506) N=296	0.393 (p=0.0000) N=300	0.186 (p=0.0013) N=296	0.403 (p=0.0000) N=301	0.041 (p=0.4900) N=292
51	0.068 (p=0.2428) N=298	0.162 (p=0.0051) N=299	0.097 (p=0.0926) N=299	0.261 (p=0.0000) N=300	0.186 (p=0.0012) N=300	0.515 (p=0.0000) N=301	0.336 (p=0.0000) N=302	0.179 (p=0.0019) N=297

	AL	AM	AN	AO	AP	AQ	AR	AS
1	E3.3. Strong external horizontal cooperation and partnership with neighboring and other peer municipalities	B3.4. Insufficient vertical coordination and cooperation between national, regional, and local authorities	E3.4. Effective vertical climate governance across all government levels (national, regional, local)	B3.5. Difficulty in engaging and forming partnerships with local stakeholders for co-creation and joint implementation	E3.5. Strong stakeholder engagement (e.g., businesses, residents) in local climate action	B4.1. Lack of climate policy champions	E4.1. Presence of dedicated climate policy champions among local leaders	B4.2. Lack of clear vision, guidance, and leadership by the upper echelons of government (high-level political context)
2	0.088 (p=0.1317) N=295	0.001 (p=0.9838) N=298	0.154 (p=0.0074) N=301	0.025 (p=0.6641) N=295	0.183 (p=0.0015) N=298	0.066 (p=0.2601) N=293	0.195 (p=0.0007) N=296	0.012 (p=0.8378) N=296
3	0.176 (p=0.0024) N=295	0.013 (p=0.8259) N=298	0.161 (p=0.0052) N=302	0.135 (p=0.0206) N=295	0.288 (p=0.0000) N=298	-0.020 (p=0.7378) N=294	0.205 (p=0.0004) N=296	-0.024 (p=0.6798) N=296
4	0.212 (p=0.0002) N=295	-0.009 (p=0.8806) N=297	0.172 (p=0.0028) N=301	0.092 (p=0.1140) N=295	0.303 (p=0.0000) N=298	-0.082 (p=0.1602) N=295	0.254 (p=0.0000) N=296	-0.031 (p=0.5984) N=297
5	0.209 (p=0.0003) N=298	0.014 (p=0.8125) N=300	0.228 (p=0.0001) N=303	0.017 (p=0.7743) N=297	0.184 (p=0.0013) N=300	0.059 (p=0.3122) N=295	0.209 (p=0.0003) N=299	0.004 (p=0.9412) N=298
6	0.220 (p=0.0001) N=292	-0.047 (p=0.4165) N=295	0.144 (p=0.0127) N=298	-0.051 (p=0.3850) N=294	0.150 (p=0.0100) N=296	-0.060 (p=0.3018) N=294	0.099 (p=0.0916) N=294	0.050 (p=0.3930) N=294
7	0.206 (p=0.0004) N=295	0.008 (p=0.8969) N=297	0.211 (p=0.0002) N=300	-0.017 (p=0.7717) N=296	0.265 (p=0.0000) N=297	-0.168 (p=0.0039) N=293	0.206 (p=0.0004) N=295	0.053 (p=0.3613) N=296
8	0.167 (p=0.0040) N=294	0.062 (p=0.2858) N=297	0.107 (p=0.0635) N=299	0.062 (p=0.2869) N=296	0.155 (p=0.0074) N=296	-0.016 (p=0.7878) N=293	0.202 (p=0.0005) N=294	0.113 (p=0.0527) N=295
9	0.127 (p=0.0297) N=295	-0.043 (p=0.4582) N=298	0.134 (p=0.0199) N=300	0.108 (p=0.0637) N=296	0.218 (p=0.0001) N=298	-0.044 (p=0.4564) N=294	0.147 (p=0.0115) N=296	-0.007 (p=0.9062) N=297
10	0.125 (p=0.0332) N=292	0.036 (p=0.5383) N=295	0.146 (p=0.0120) N=297	0.002 (p=0.9709) N=293	0.189 (p=0.0012) N=294	-0.157 (p=0.0073) N=290	0.137 (p=0.0193) N=292	-0.017 (p=0.7785) N=293
11	0.080 (p=0.1695) N=296	0.154 (p=0.0076) N=299	0.147 (p=0.0109) N=301	0.300 (p=0.0000) N=296	0.042 (p=0.4661) N=299	0.373 (p=0.0000) N=294	0.278 (p=0.0000) N=297	0.165 (p=0.0042) N=298
12	0.151 (p=0.0091) N=298	-0.019 (p=0.7388) N=299	0.144 (p=0.0125) N=302	0.141 (p=0.0152) N=296	0.226 (p=0.0001) N=300	0.149 (p=0.0105) N=295	0.353 (p=0.0000) N=298	0.001 (p=0.9875) N=298
13	0.076 (p=0.1941) N=293	0.262 (p=0.0000) N=298	0.175 (p=0.0024) N=299	0.206 (p=0.0004) N=295	0.168 (p=0.0036) N=297	0.227 (p=0.0001) N=294	0.162 (p=0.0053) N=295	0.234 (p=0.0000) N=296
14	0.279 (p=0.0000) N=291	0.107 (p=0.0677) N=292	0.275 (p=0.0000) N=294	0.159 (p=0.0070) N=288	0.256 (p=0.0000) N=292	0.182 (p=0.0020) N=288	0.174 (p=0.0028) N=292	0.171 (p=0.0035) N=291
15	0.225 (p=0.0001) N=286	0.325 (p=0.0000) N=290	0.215 (p=0.0002) N=291	0.193 (p=0.0010) N=287	0.189 (p=0.0012) N=291	0.260 (p=0.0000) N=286	0.154 (p=0.0088) N=288	0.343 (p=0.0000) N=288
16	0.231 (p=0.0001) N=296	0.227 (p=0.0001) N=298	0.425 (p=0.0000) N=302	0.122 (p=0.0369) N=295	0.279 (p=0.0000) N=299	0.121 (p=0.0382) N=293	0.283 (p=0.0000) N=297	0.289 (p=0.0000) N=296
17	0.077 (p=0.1866) N=294	0.256 (p=0.0000) N=298	0.219 (p=0.0001) N=300	0.305 (p=0.0000) N=294	0.131 (p=0.0237) N=298	0.284 (p=0.0000) N=294	0.158 (p=0.0065) N=296	0.187 (p=0.0012) N=297
18	0.102 (p=0.0783) N=297	0.117 (p=0.0431) N=298	0.345 (p=0.0000) N=302	0.219 (p=0.0001) N=295	0.240 (p=0.0000) N=300	0.205 (p=0.0004) N=294	0.237 (p=0.0000) N=298	0.158 (p=0.0062) N=297
19	0.091 (p=0.1244) N=288	0.253 (p=0.0000) N=291	0.228 (p=0.0001) N=292	0.308 (p=0.0000) N=289	0.158 (p=0.0069) N=291	0.296 (p=0.0000) N=288	0.127 (p=0.0308) N=289	0.295 (p=0.0000) N=291
20	0.154 (p=0.0079) N=297	0.082 (p=0.1573) N=296	0.297 (p=0.0000) N=300	0.192 (p=0.0009) N=294	0.190 (p=0.0010) N=298	0.151 (p=0.0095) N=293	0.190 (p=0.0010) N=297	0.152 (p=0.0088) N=296
21	0.186 (p=0.0015) N=291	0.193 (p=0.0006) N=297	0.267 (p=0.0000) N=297	0.267 (p=0.0000) N=293	0.164 (p=0.0047) N=296	0.246 (p=0.0000) N=292	0.299 (p=0.0000) N=293	0.167 (p=0.0041) N=296
22	0.312 (p=0.0000) N=293	0.091 (p=0.1200) N=293	0.360 (p=0.0000) N=298	0.010 (p=0.8626) N=292	0.282 (p=0.0000) N=295	0.081 (p=0.1679) N=290	0.258 (p=0.0000) N=294	0.039 (p=0.5071) N=293
23	0.135 (p=0.0208) N=295	0.116 (p=0.0446) N=299	0.185 (p=0.0012) N=301	0.202 (p=0.0005) N=296	0.117 (p=0.0431) N=299	0.242 (p=0.0000) N=296	0.167 (p=0.0037) N=298	0.229 (p=0.0001) N=298
24	0.256 (p=0.0000) N=295	0.124 (p=0.0323) N=298	0.289 (p=0.0000) N=301	0.177 (p=0.0022) N=295	0.124 (p=0.0324) N=299	0.199 (p=0.0006) N=294	0.257 (p=0.0000) N=297	0.168 (p=0.0037) N=296
25	0.272 (p=0.0000) N=283	0.234 (p=0.0001) N=287	0.266 (p=0.0000) N=288	0.318 (p=0.0000) N=285	0.226 (p=0.0001) N=286	0.304 (p=0.0000) N=284	0.134 (p=0.0238) N=284	0.291 (p=0.0000) N=287
26	0.304 (p=0.0000) N=291	0.160 (p=0.0059) N=293	0.369 (p=0.0000) N=296	0.194 (p=0.0009) N=290	0.307 (p=0.0000) N=294	0.176 (p=0.0026) N=289	0.285 (p=0.0000) N=293	0.143 (p=0.0145) N=291
27	0.274 (p=0.0000) N=295	0.253 (p=0.0000) N=299	0.293 (p=0.0000) N=291	0.214 (p=0.0002) N=296	0.223 (p=0.0001) N=299	0.275 (p=0.0000) N=295	0.278 (p=0.0000) N=298	0.286 (p=0.0000) N=297
28	0.453 (p=0.0000) N=292	0.104 (p=0.0764) N=292	0.388 (p=0.0000) N=296	0.065 (p=0.2657) N=291	0.395 (p=0.0000) N=294	0.091 (p=0.1214) N=288	0.324 (p=0.0000) N=292	0.212 (p=0.0003) N=292
29	0.207 (p=0.0004) N=292	0.224 (p=0.0001) N=297	0.150 (p=0.0093) N=298	0.276 (p=0.0000) N=295	0.145 (p=0.0125) N=297	0.205 (p=0.0004) N=293	0.205 (p=0.0004) N=295	0.210 (p=0.0003) N=295
30	0.314 (p=0.0000) N=295	0.167 (p=0.0039) N=296	0.305 (p=0.0000) N=300	0.201 (p=0.0005) N=293	0.363 (p=0.0000) N=298	0.111 (p=0.0574) N=292	0.224 (p=0.0001) N=296	0.171 (p=0.0033) N=295
31	0.194 (p=0.0008) N=294	0.220 (p=0.0001) N=297	0.187 (p=0.0011) N=300	0.219 (p=0.0002) N=295	0.185 (p=0.0013) N=298	0.143 (p=0.0143) N=293	0.173 (p=0.0028) N=297	0.221 (p=0.0001) N=296
32	0.390 (p=0.0000) N=295	0.058 (p=0.3163) N=296	0.288 (p=0.0000) N=301	0.189 (p=0.0011) N=293	0.334 (p=0.0000) N=299	0.066 (p=0.2611) N=292	0.209 (p=0.0003) N=297	0.094 (p=0.1059) N=295
33	0.174 (p=0.0028) N=293	0.276 (p=0.0000) N=299	0.203 (p=0.0004) N=299	0.358 (p=0.0000) N=296	0.122 (p=0.0350) N=298	0.358 (p=0.0000) N=295	0.143 (p=0.0140) N=295	0.386 (p=0.0000) N=296
34	0.422 (p=0.0000) N=296	0.118 (p=0.0430) N=297	0.385 (p=0.0000) N=302	0.212 (p=0.0003) N=294	0.367 (p=0.0000) N=300	0.225 (p=0.0001) N=294	0.317 (p=0.0000) N=298	0.150 (p=0.0098) N=296
35	0.077 (p=0.1908) N=294	0.268 (p=0.0000) N=298	0.159 (p=0.0058) N=299	0.389 (p=0.0000) N=295	0.109 (p=0.0602) N=298	0.343 (p=0.0000) N=294	0.236 (p=0.0000) N=296	0.215 (p=0.0002) N=296
36	0.275 (p=0.0000) N=298	0.106 (p=0.0660) N=299	0.400 (p=0.0000) N=304	0.125 (p=0.0317) N=296	0.411 (p=0.0000) N=302	0.133 (p=0.0221) N=295	0.425 (p=0.0000) N=300	0.038 (p=0.5167) N=298
37	0.190 (p=0.0012) N=290	0.472 (p=0.0000) N=295	0.181 (p=0.0018) N=295	0.345 (p=0.0000) N=292	0.127 (p=0.0297) N=294	0.272 (p=0.0000) N=292	0.029 (p=0.6202) N=291	0.349 (p=0.0000) N=295
38		0.161 (p=0.0057) N=292	0.495 (p=0.0000) N=296	0.101 (p=0.0881) N=289	0.370 (p=0.0000) N=293	0.057 (p=0.3372) N=287	0.218 (p=0.0002) N=292	0.191 (p=0.0010) N=293
39	0.161 (p=0.0057) N=292		0.316 (p=0.0000) N=298	0.428 (p=0.0000) N=296	0.128 (p=0.0282) N=296	0.324 (p=0.0000) N=292	0.025 (p=0.6688) N=293	0.544 (p=0.0000) N=296
40	0.495 (p=0.0000) N=296	0.316 (p=0.0000) N=298		0.182 (p=0.0017) N=295	0.511 (p=0.0000) N=300	0.123 (p=0.0359) N=293	0.308 (p=0.0000) N=298	0.230 (p=0.0001) N=295
41	0.101 (p=0.0881) N=289	0.428 (p=0.0000) N=296	0.182 (p=0.0017) N=295		0.204 (p=0.0004) N=293	0.414 (p=0.0000) N=290	0.033 (p=0.5747) N=290	0.323 (p=0.0000) N=292
42	0.370 (p=0.0000) N=293	0.128 (p=0.0282) N=296	0.511 (p=0.0000) N=300	0.204 (p=0.0004) N=293		0.087 (p=0.1367) N=292	0.349 (p=0.0000) N=296	0.159 (p=0.0061) N=294
43	0.057 (p=0.3372) N=287	0.324 (p=0.0000) N=292	0.123 (p=0.0359) N=293	0.414 (p=0.0000) N=290	0.087 (p=0.1367) N=292		0.207 (p=0.0004) N=289	0.453 (p=0.0000) N=292
44	0.218 (p=0.0002) N=292	0.025 (p=0.6688) N=293	0.308 (p=0.0000) N=298	0.033 (p=0.5747) N=290	0.349 (p=0.0000) N=296	0.207 (p=0.0004) N=289		0.029 (p=0.6258) N=291
45	0.191 (p=0.0010) N=293	0.544 (p=0.0000) N=296	0.230 (p=0.0001) N=295	0.323 (p=0.0000) N=292	0.159 (p=0.0061) N=294	0.453 (p=0.0000) N=292	0.029 (p=0.6258) N=291	
46	0.129 (p=0.0270) N=292	0.101 (p=0.0852) N=294	0.357 (p=0.0000) N=299	0.111 (p=0.0577) N=291	0.309 (p=0.0000) N=296	0.093 (p=0.1157) N=290	0.433 (p=0.0000) N=298	0.101 (p=0.0859) N=291
47	0.133 (p=0.0254) N=282	0.328 (p=0.0000) N=285	0.098 (p=0.0985) N=285	0.357 (p=0.0000) N=281	0.022 (p=0.7152) N=283	0.626 (p=0.0000) N=283	0.138 (p=0.0199) N=283	0.438 (p=0.0000) N=285
48	0.251 (p=0.0000) N=288	0.098 (p=0.0963) N=290	0.298 (p=0.0000) N=293	0.070 (p=0.2361) N=288	0.339 (p=0.0000) N=292	0.167 (p=0.0045) N=287	0.517 (p=0.0000) N=293	0.070 (p=0.2337) N=288
49	0.172 (p=0.0035) N=288	0.215 (p=0.0002) N=291	0.139 (p=0.0175) N=293	0.367 (p=0.0000) N=290	0.175 (p=0.0028) N=291	0.328 (p=0.0000) N=290	0.091 (p=0.1238) N=289	0.225 (p=0.0001) N=291
50	0.312 (p=0.0000) N=294	0.041 (p=0.4795) N=295	0.305 (p=0.0000) N=300	0.128 (p=0.0284) N=292	0.500 (p=0.0000) N=297	0.041 (p=0.4910) N=290	0.423 (p=0.0000) N=298	0.028 (p=0.6274) N=293
51	0.088 (p=0.1305) N=294	0.217 (p=0.0002) N=298	0.161 (p=0.0051) N=300	0.314 (p=0.0000) N=296	0.164 (p=0.0045) N=299	0.401 (p=0.0000) N=295	0.188 (p=0.0011) N=296	0.207 (p=0.0003) N=297

	AT	AU	AV	AW	AX	AY
1	E4.2. Strong vision, enthusiasm and leadership by the upper echelons of government (national, provincial)	B4.3. Low continuity and priority of climate action on municipal agenda	E4.3. High priority, continuity, and favorability toward environmental action on local agenda	B4.4. Low public interest, involvement, and demand for climate policy	E4.4. Citizens exhibiting high interest and demand for climate policy	B4.5. Weak problem perception or skepticism within the city hall
2	0.159 (p=0.0060) N=297	-0.069 (p=0.2492) N=284	0.168 (p=0.0040) N=291	0.006 (p=0.8848) N=294	0.117 (p=0.0435) N=298	0.143 (p=0.0131) N=299
3	0.214 (p=0.0002) N=297	0.025 (p=0.6785) N=284	0.176 (p=0.0026) N=291	-0.015 (p=0.7978) N=295	0.295 (p=0.0000) N=298	0.024 (p=0.6744) N=299
4	0.164 (p=0.0047) N=297	-0.040 (p=0.5042) N=286	0.195 (p=0.0008) N=293	0.117 (p=0.0438) N=295	0.247 (p=0.0000) N=297	0.076 (p=0.1893) N=300
5	0.140 (p=0.0153) N=299	0.163 (p=0.0058) N=287	0.226 (p=0.0001) N=293	0.011 (p=0.8485) N=296	0.213 (p=0.0002) N=300	-0.067 (p=0.2492) N=301
6	0.117 (p=0.0452) N=294	-0.065 (p=0.2709) N=285	0.058 (p=0.3212) N=290	0.019 (p=0.7479) N=294	0.159 (p=0.0063) N=295	-0.057 (p=0.3279) N=298
7	0.198 (p=0.0006) N=296	-0.062 (p=0.2985) N=284	0.190 (p=0.0011) N=291	0.101 (p=0.0824) N=296	0.317 (p=0.0000) N=297	-0.010 (p=0.8655) N=299
8	0.174 (p=0.0027) N=296	0.009 (p=0.8836) N=285	0.153 (p=0.0088) N=291	0.034 (p=0.5667) N=294	0.150 (p=0.0097) N=296	-0.046 (p=0.4291) N=298
9	0.054 (p=0.3566) N=296	0.039 (p=0.5116) N=285	0.088 (p=0.1308) N=293	0.159 (p=0.0064) N=295	0.205 (p=0.0004) N=297	0.005 (p=0.9377) N=300
10	0.112 (p=0.0549) N=293	-0.054 (p=0.3647) N=281	0.088 (p=0.1376) N=289	-0.014 (p=0.8117) N=291	0.223 (p=0.0001) N=294	-0.033 (p=0.5667) N=296
11	0.192 (p=0.0009) N=297	0.290 (p=0.0000) N=288	0.215 (p=0.0002) N=292	0.257 (p=0.0000) N=295	0.128 (p=0.0265) N=299	0.384 (p=0.0000) N=301
12	0.243 (p=0.0000) N=298	0.000 (p=0.9980) N=287	0.273 (p=0.0000) N=294	0.184 (p=0.0014) N=296	0.267 (p=0.0000) N=299	0.212 (p=0.0002) N=301
13	0.177 (p=0.0023) N=295	0.222 (p=0.0001) N=287	0.105 (p=0.0744) N=290	0.196 (p=0.0007) N=295	0.116 (p=0.0469) N=296	0.218 (p=0.0001) N=299
14	0.211 (p=0.0003) N=291	0.213 (p=0.0003) N=282	0.294 (p=0.0000) N=287	0.150 (p=0.0109) N=289	0.243 (p=0.0000) N=292	0.204 (p=0.0004) N=293
15	0.201 (p=0.0006) N=287	0.324 (p=0.0000) N=279	0.192 (p=0.0012) N=283	0.203 (p=0.0005) N=286	0.151 (p=0.0101) N=288	0.235 (p=0.0000) N=292
16	0.472 (p=0.0000) N=298	0.181 (p=0.0021) N=285	0.329 (p=0.0000) N=292	0.125 (p=0.0326) N=294	0.215 (p=0.0002) N=299	0.109 (p=0.0598) N=300
17	0.187 (p=0.0012) N=296	0.217 (p=0.0002) N=287	0.187 (p=0.0014) N=291	0.168 (p=0.0039) N=294	0.059 (p=0.3139) N=297	0.187 (p=0.0011) N=300
18	0.282 (p=0.0000) N=298	0.138 (p=0.0192) N=286	0.285 (p=0.0000) N=294	0.193 (p=0.0008) N=295	0.217 (p=0.0002) N=299	0.141 (p=0.0145) N=301
19	0.203 (p=0.0005) N=288	0.190 (p=0.0014) N=281	0.141 (p=0.0173) N=285	0.197 (p=0.0008) N=287	0.021 (p=0.7275) N=289	0.242 (p=0.0000) N=294
20	0.253 (p=0.0000) N=296	0.105 (p=0.0749) N=286	0.214 (p=0.0002) N=293	0.180 (p=0.0019) N=294	0.120 (p=0.0393) N=297	0.095 (p=0.1006) N=300
21	0.235 (p=0.0000) N=293	0.218 (p=0.0002) N=286	0.268 (p=0.0000) N=289	0.226 (p=0.0001) N=291	0.191 (p=0.0010) N=294	0.304 (p=0.0000) N=298
22	0.268 (p=0.0000) N=293	0.049 (p=0.4062) N=284	0.309 (p=0.0000) N=289	0.126 (p=0.0320) N=290	0.242 (p=0.0000) N=294	0.069 (p=0.2324) N=297
23	0.071 (p=0.2213) N=298	0.175 (p=0.0030) N=287	0.207 (p=0.0004) N=293	0.117 (p=0.0435) N=296	0.103 (p=0.0761) N=298	0.222 (p=0.0001) N=301
24	0.212 (p=0.0002) N=297	0.122 (p=0.0402) N=285	0.224 (p=0.0001) N=293	0.078 (p=0.1801) N=294	0.151 (p=0.0090) N=298	0.124 (p=0.0318) N=300
25	0.175 (p=0.0030) N=284	0.311 (p=0.0000) N=276	0.238 (p=0.0001) N=279	0.276 (p=0.0000) N=285	0.161 (p=0.0063) N=285	0.178 (p=0.0024) N=288
26	0.191 (p=0.0010) N=292	0.146 (p=0.0146) N=281	0.329 (p=0.0000) N=288	0.205 (p=0.0004) N=289	0.276 (p=0.0000) N=293	0.203 (p=0.0005) N=295
27	0.209 (p=0.0003) N=298	0.240 (p=0.0000) N=286	0.228 (p=0.0001) N=294	0.275 (p=0.0000) N=295	0.215 (p=0.0002) N=299	0.305 (p=0.0000) N=300
28	0.304 (p=0.0000) N=292	0.102 (p=0.0866) N=281	0.331 (p=0.0000) N=289	0.185 (p=0.0016) N=289	0.369 (p=0.0000) N=294	0.086 (p=0.1419) N=295
29	0.114 (p=0.0498) N=295	0.154 (p=0.0094) N=283	0.182 (p=0.0018) N=292	0.200 (p=0.0006) N=294	0.176 (p=0.0024) N=296	0.235 (p=0.0000) N=298
30	0.235 (p=0.0000) N=296	0.042 (p=0.4773) N=284	0.240 (p=0.0000) N=292	0.141 (p=0.0154) N=293	0.316 (p=0.0000) N=297	0.068 (p=0.2428) N=298
31	0.050 (p=0.3880) N=297	0.156 (p=0.0086) N=284	0.200 (p=0.0006) N=292	0.158 (p=0.0066) N=295	0.139 (p=0.0165) N=298	0.162 (p=0.0051) N=299
32	0.149 (p=0.0103) N=297	0.121 (p=0.0411) N=284	0.204 (p=0.0005) N=292	0.136 (p=0.0200) N=292	0.289 (p=0.0000) N=298	0.097 (p=0.0926) N=299
33	0.029 (p=0.6187) N=295	0.378 (p=0.0000) N=286	0.118 (p=0.0448) N=291	0.252 (p=0.0000) N=294	0.054 (p=0.3506) N=296	0.261 (p=0.0000) N=300
34	0.311 (p=0.0000) N=298	0.122 (p=0.0393) N=286	0.350 (p=0.0000) N=293	0.266 (p=0.0000) N=294	0.393 (p=0.0000) N=300	0.186 (p=0.0012) N=300
35	0.049 (p=0.4040) N=295	0.376 (p=0.0000) N=285	0.209 (p=0.0003) N=291	0.309 (p=0.0000) N=293	0.186 (p=0.0013) N=296	0.515 (p=0.0000) N=301
36	0.334 (p=0.0000) N=300	0.106 (p=0.0722) N=287	0.402 (p=0.0000) N=295	0.211 (p=0.0003) N=296	0.403 (p=0.0000) N=301	0.336 (p=0.0000) N=302
37	0.094 (p=0.1093) N=291	0.230 (p=0.0001) N=285	0.147 (p=0.0127) N=288	0.143 (p=0.0149) N=291	0.041 (p=0.4900) N=292	0.179 (p=0.0019) N=297
38	0.129 (p=0.0270) N=292	0.133 (p=0.0254) N=282	0.251 (p=0.0000) N=288	0.172 (p=0.0035) N=288	0.312 (p=0.0000) N=294	0.088 (p=0.1305) N=294
39	0.101 (p=0.0852) N=294	0.328 (p=0.0000) N=285	0.098 (p=0.0963) N=290	0.215 (p=0.0002) N=291	0.041 (p=0.4795) N=295	0.217 (p=0.0002) N=298
40	0.357 (p=0.0000) N=299	0.098 (p=0.0985) N=285	0.298 (p=0.0000) N=293	0.139 (p=0.0175) N=293	0.305 (p=0.0000) N=300	0.161 (p=0.0051) N=300
41	0.111 (p=0.0577) N=291	0.357 (p=0.0000) N=281	0.070 (p=0.2361) N=288	0.367 (p=0.0000) N=290	0.128 (p=0.0284) N=292	0.314 (p=0.0000) N=296
42	0.309 (p=0.0000) N=296	0.022 (p=0.7152) N=283	0.339 (p=0.0000) N=292	0.175 (p=0.0028) N=291	0.500 (p=0.0000) N=297	0.164 (p=0.0045) N=299
43	0.093 (p=0.1157) N=290	0.628 (p=0.0000) N=283	0.167 (p=0.0045) N=287	0.328 (p=0.0000) N=290	0.041 (p=0.4910) N=290	0.401 (p=0.0000) N=295
44	0.433 (p=0.0000) N=298	0.138 (p=0.0199) N=283	0.517 (p=0.0000) N=293	0.091 (p=0.1238) N=289	0.423 (p=0.0000) N=298	0.188 (p=0.0011) N=296
45	0.101 (p=0.0859) N=291	0.438 (p=0.0000) N=285	0.070 (p=0.2337) N=288	0.225 (p=0.0001) N=291	0.028 (p=0.6274) N=293	0.207 (p=0.0003) N=297
46		0.059 (p=0.3188) N=283	0.441 (p=0.0000) N=294	0.093 (p=0.1154) N=289	0.380 (p=0.0000) N=299	0.098 (p=0.0914) N=296
47	0.059 (p=0.3188) N=283		0.213 (p=0.0003) N=279	0.321 (p=0.0000) N=282	0.095 (p=0.1091) N=284	0.255 (p=0.0000) N=286
48	0.441 (p=0.0000) N=294	0.213 (p=0.0003) N=279		0.230 (p=0.0001) N=286	0.584 (p=0.0000) N=293	0.259 (p=0.0000) N=293
49	0.093 (p=0.1154) N=289	0.321 (p=0.0000) N=282	0.230 (p=0.0001) N=286		0.228 (p=0.0001) N=290	0.489 (p=0.0000) N=294
50	0.380 (p=0.0000) N=299	0.095 (p=0.1091) N=284	0.584 (p=0.0000) N=293	0.228 (p=0.0001) N=290		0.262 (p=0.0000) N=297
51	0.098 (p=0.0914) N=296	0.255 (p=0.0000) N=286	0.259 (p=0.0000) N=293	0.489 (p=0.0000) N=294	0.262 (p=0.0000) N=297	

Appendix D. Working Paper²⁰

Exploring Conducive Background, Initiatives and Challenges of Local Movement Towards Net-Zero Emissions: A Transdisciplinary Approach

MYASOEDOV Fedor

Division of Advanced Integrated Studies in Human Survivability

Graduate school of Advanced Integrated Studies in Human Survivability

Kyoto University

Doctoral course, 5th year student

February 15th, 2023

²⁰ The working paper is the report submitted at GSAIS, Kyoto University, for admission to the PhD qualification. It describes results from the fieldwork, Musha-shugyo internship, and the Project-Based Research

Table of Contents

List of tables, figures, and abbreviations.....	2
1. Introduction.....	3
2. Methodology: A transdisciplinary approach.....	4
3. Accessing the research field – Internship.....	5
3.1 Internship Overview.....	5
3.2 Fieldwork Implementation.....	5
3.3 Summary of Fieldwork Findings.....	6
3.3.1 Exploring conducive background for ‘Zero Carbon City’ declarations and examples of municipal initiatives towards net-zero emissions.....	6
A) Historical and socio-economic background (Case: Kitakyushu city).....	6
B) Geography and local resource endowments (Cases: Oguni town, Morotsuka village, Kushima city).....	8
C) Institutional & administrative background (Saga city; Saga Prefecture; Nagasaki city; Nagasaki pref.).....	10
3.3.2 Challenges.....	11
3.4 Conclusions from fieldwork.....	13
4. Project-Based Research (PBR) - International Forum on Zero Carbon Cities.....	13
4.1 Background.....	13
4.2 PBR implementation.....	14
4.3 Summary of the international forum.....	16
4.4 Conclusions and social significance of the PBR.....	18
5. Other action research contributions.....	19
5.1 Organizing a study webinar “Russia’s NDC under the Paris Agreement: An Overview of Russia’s Policy and Politics of Climate Change”.....	19
5.2 Attending a public hearing on the release of the Kitakyushu City Global Warming Countermeasures Action Plan draft and submitting the comments on the plan to the city government.....	20
5.3 Raising awareness on SDGs by organizing the “2030 SDGs Game”.....	20
6. Conclusions.....	21
7. References.....	21

List of Tables

Table D1. List of fieldwork activities and corresponding codes assigned for each activity.....	6
Table D2. Summary of conducive background factors for net-zero commitments by local governments, based on fieldwork findings.....	11
Table D3. Summary of challenges for effective climate action by local governments, based on fieldwork findings.....	13
Table D4. International forum participant structure.....	15

List of Figures

Figure D1. Transdisciplinary activities conducted by author, according to different “action researcher roles” (Wittmayer, 2014).....	5
Figure D2. Map of fieldwork activities during the internship.	6
Figure D3. Position of the PBR in the research design.	13
Figure D4. Countries and cities of the forum’s attendees.	14
Figure D5. Questions submitted online at the forum.	14
Figure D6. Word cloud of the most frequently used word combinations at the forum.....	15
Figure D7. Three-pronged social contribution of the PBR.	18
Figure D8. IGES Study Webinar - “Russia’s NDC under the Paris Agreement”	19
Figure D9. Kitakyushu City Global Warming Countermeasures Action Plan draft .	19
Image D1. Composting workshop image.....	8
Image D2. Omoyai farm company logo	8
Photo D1. Eco-town Next Generation Energy Park.	7
Photo D2. Wind turbine maintenance and recycling plant located in the Eco-town.	8
Photo D3. Sustainable residential district BONJONO.	8
Photo D4. Attending a citizen engagement workshop at Hibikino Citizen Center.	8
Photo D5. Urban horticulture social business.	7
Photo D6. Small hydropower project run by local community in Oguni town.	9
Photo D7. 'Mosaic' forestry in Morotsuka village.	9
Photo D8. 'Kushima Windhill' wind farm.	9
Photo D9. 2030 SDGs Game at Kyoto University.	21

List of Abbreviations

BRT - Bus Rapid Transit
CAP - Climate Action Plan
CNP - Carbon Neutral Port
COP - Conference of the Parties (at the UNFCCC)
FAO - Food and Agriculture Organization of the United Nations
FSC - Forest Stewardship Council
GHG - Greenhouse gas
GIAHS - Globally Important Agricultural Heritage Systems
GSAIS - Graduate school of Advanced Integrated Studies in Human Survivability
IBA - Important Bird and Biodiversity Area
IGES - Institute for Global Environmental Strategies
IPCC - Intergovernmental Panel on Climate Change
KUC - Kitakyushu Urban Centre
METI - Ministry of Economy, Trade and Industry, Japan
MLIT - The Ministry of Land, Infrastructure, Transport and Tourism, Japan
MOEJ - Ministry of the Environment, Japan
NDC - Nationally Determined Contributions (under Paris Agreement)
NIES - National Institute for Environmental Studies, Japan
PBR – Project-Based Research
SDGs - Sustainable Development Goals
SMEs - Small and Medium Enterprises
UNFCCC - United Nations Framework Convention on Climate Change

1. Introduction

We are living in an unprecedented time where numerous global challenges threaten human survival. Climate change is one such issue, which is also characterized by enormous complexity with no clear ‘one-size-fits-all’ solution. These challenges span most sectors of human activity, most actors of society and transcend the traditional boundaries of academic disciplines (Sachs, 2015). International conventions, such as Kyoto Protocol and Paris Agreement, have been showing the way forward by setting the milestones for global community to achieve. It has been agreed that to keep the global warming below 1.5 Celsius, nation-states must pursue all actions towards decarbonization to at least net-zero level of GHG emissions by 2050, where net-zero is a concept of the balance between emissions from human activity and absorption through natural processes by greenery and oceans. Yet nations are slow in their response, and the long-term goals (e.g., net-zero by 2050/2060 or only peak emissions by 2030) that they set have resulted in an ‘action gap’ issue, when political commitments are not reflected in real policies and substantial actions are not being taken (Climate Action Tracker, 2022).

In this context of sluggish and inflexible measures taken by the nation-states, the actions of non-state actors, such as businesses forming climate alliances and local governments coming forward with their own forward-looking commitments and initiatives have been attracting considerable attention. Ever since the Kyoto Protocol, certain cities with long history of environmental action (e.g., Stockholm, Sweden; Portland, US; etc.) have been announcing ambitious emissions reduction plans and have been experimenting with pioneering climate action without necessarily waiting for national governments to create enabling frameworks and favorable conditions for such action. The trend of cities spearheading forward the climate action agenda has picked up in pace even further since Paris Agreement (2015) and the release of the Global Warming of 1.5°C IPCC report in October 2018 (Ruiz-Campillo et al., 2021).

Several countries, including Germany, Italy, USA, Canada, and South Korea, have seen climate emergency declarations and net zero commitments from local governments quickly rise in numbers. Since 2018, over 75% of local authorities in the UK declared climate emergencies and committed to achieving net-zero carbon emissions (Gudde et al., 2021). In Japan, local governments²¹ have ramped up net-zero commitment declarations since May 2019 within the so-called “Zero Carbon City” framework promoted by the Ministry of Environment of Japan (MOEJ). As of October 2022, 797 local governments, covering the population of 119 million people (~95% of Japan’s population) have already announced the commitment to achieve net-zero CO₂ emissions by 2050. 134 municipalities had made their net-zero declarations before October 2020, when the central government announced ‘net-zero by 2050’ as a national goal (MOEJ, 2022).

Clearly, certain background factors and motivations have been at work in such forerunner municipalities, which have contributed to triggering their net-zero commitment declarations. Knowing these factors would help in understanding how to sway other municipalities to follow suit. Therefore, it would be beneficial to know:

- **What kind of supportive background have been conducive to triggering net-zero commitments by municipalities in Japan?**

In addition, considering the action gap (i.e., the gap between actions announced and progress made) it is also important to get a clearer picture of what actions are being taken on the ground. In other words,

²¹ Local governments system in Japan is 2-tier”: prefectures and the municipalities (i.e. cities, towns, villages) that make up the prefectures.

- **How do municipalities intend to achieve net-zero goals, and which concrete initiatives have they undertaken so far?**

It is also equally important to clarify why many critical measures are not being implemented and what barriers stand on the way towards decarbonization in municipalities. In other words,

- **What challenges and barriers towards decarbonization are municipalities encountering?**

All these questions have informed the research which forms the basis of this working paper.

2. Methodology: A transdisciplinary approach

Given the complexity of climate change policy, scholars from various academic disciplines are calling for a new approach in designing and implementing academic research. While scholars employ various conceptualizations and interpretations²², generally this novel research method advocates knowledge co-creation and the engagement of societal stakeholders in the research process (Wittmayer, 2014; Renn, 2021). They emphasize that the best way to approaching complex problems is to “include multiple visions of the future and to include the expectations of the societal actors with respect to new evolving trends and transformations” as well as “create a discourse structure for mutual learning that provides the foundation for addressing wicked problems with long-term implications” (Renn, 2021). Thus, this approach emphasizes that new knowledge created through the research process should not be just created within the academy or for the sake of the “ivory tower”, but should include involvement, consultation, debate, and deliberation with a variety of relevant societal actors on the ground. Given the collaborative nature of this approach, the main investigator (researcher) must communicate and coordinate actively with stakeholders throughout the process of research and alter the research in accordance with the relevant input and feedback from them. Finally, it is essential for a researcher to realize his role not just as an impartial spectator but as an active actor, embedded in the research context, whose actions have an impact not only on the knowledge creation but also on policymaking and on larger society (Wittmayer, 2014). Transdisciplinary research methodology is often seen as means “of involving researchers directly into actions that promote the transformation towards sustainability” and recognizing the researcher’s role as “an initiator of and catalyst for sustainable transitioning” (Renn, 2021).

Based on this understanding, the author has conducted a variety of activities (see Figure D1) based on *transdisciplinary* methodology to answer the research questions. These activities correspond to various *action researcher roles*, in accordance with the framework by Wittmayer (2014):

- *Reflexive researcher*, i.e., working together with local actors on the ground – **Internship** (including fieldwork activities such as interviews, site visits and observations, exchanging knowledge with practitioners and experts, etc.)
- *Process facilitator* and *Knowledge broker*, i.e., creating a space for exchanging opinions, receiving feedback from multiple stakeholders on the survey results – **Organizing an International Forum**
- *Self-reflexive researcher*, i.e., utilizing author’s native Russian to conduct research on author’s home country situation and sharing this knowledge in English – **Organizing an International Study Webinar on Russia’s approach to climate change policy.**
- *Change agent*, i.e., civic participation – **attending a public hearing** of Kitakyushu city government release of the Climate Action Plan draft and **submitting comments** for the revision of plan.

²² e.g. “stakeholder engagement”, “knowledge co-creation”, “participatory action research”, “transition management”, “transdisciplinary research”

- *Change agent*, i.e., communicating and activism (raising awareness among citizens and youth) – Inviting a professional facilitator and **organizing an entertaining awareness rising event “2030 SDGs Game” for non-experts and the youth.**

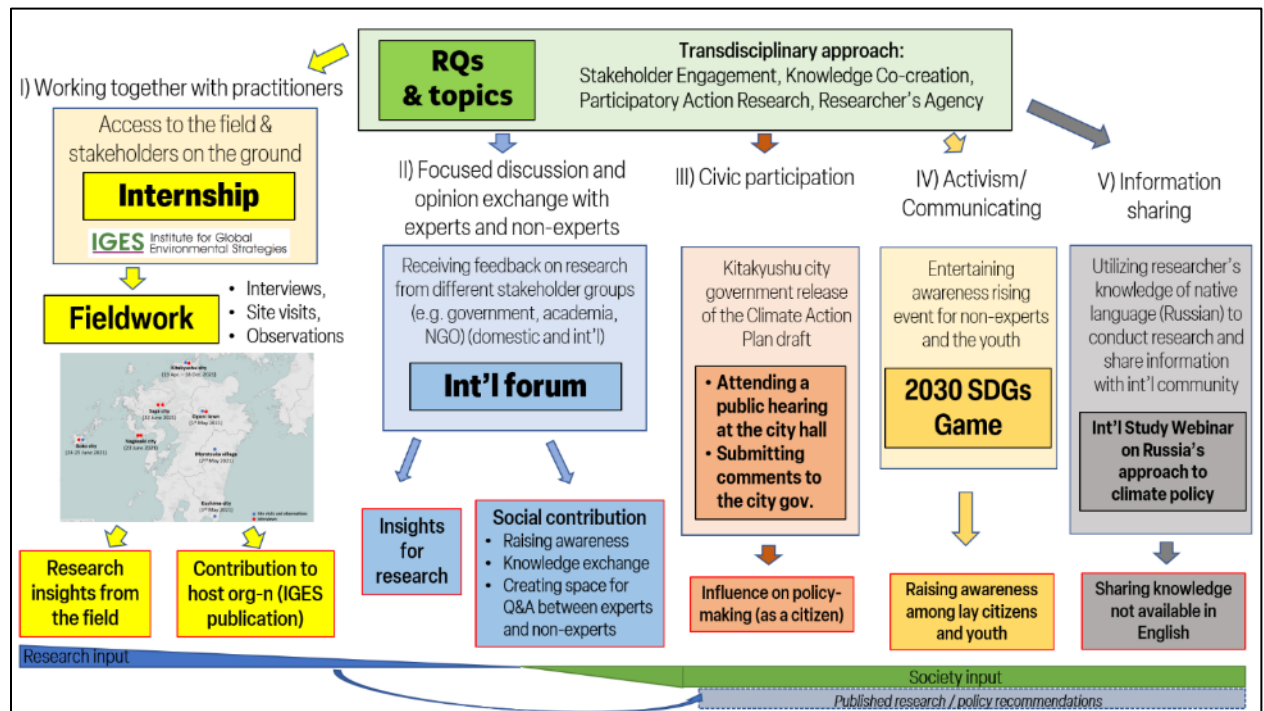


Figure D1. Transdisciplinary activities conducted by author, according to different “action researcher roles” (Wittmayer, 2014)

3. Accessing the research field – Internship

3.1 Internship Overview

Considering the “action gap” in climate policy, it is necessary to delve beneath the surface of political statements of intended actions and determine the real actions taken by municipalities as well as the challenges they face. In other words, a full understanding of net-zero action requires a researcher to ‘access to the field’ and immerse himself in concrete policy circles. To accomplish this, the author conducted a 6-month internship at the regional research institution Kitakyushu Urban Center (KUC), a satellite of the Institute of Global Environmental Studies (IGES). KUC conducts practical activities and research which lead to the implementation of policies for sustainable cities, in close partnership with local stakeholders including City of Kitakyushu and Kyushu Region (IGES, 2021). KUC is ideally positioned at the intersection of academia and policymaking, as it performs research on urban environmental policies, acts as an advisor to local governments (mainly in Kyushu region), and collaborates with both public and private sectors (IGES, 2021).

As part of the internship activities, the author conducted fieldwork in the region. This work consisted of visiting several municipalities in Kyushu region to conduct interviews with local government officials and local stakeholders, in addition to site visits of ecological initiatives and observations of local municipal initiatives towards achieving net-zero emissions. As one of the outputs of the internship at IGES, the author produced a publication (IGES Fact Sheet booklet) based on the part of the fieldwork conducted in Goto city of Nagasaki prefecture (Myasoedov & Ota, 2021).

3.2 Fieldwork Implementation

In 2020 and 2021, IGES KUC conducted research on Zero-Carbon City declarations by municipalities in Kyushu (Ota & Akagi, 2021). As part of this project, the author joined the research group in summer 2021 and visited several municipalities to interview local government officials about the background, motivations and challenges regarding recently announced Zero Carbon City declarations, in addition to site visits and observations of local initiatives (Figure D2). Codes assigned for each activity (e.g., I1, O1, S1) (see Table D1) will be used to indicate sources of information.

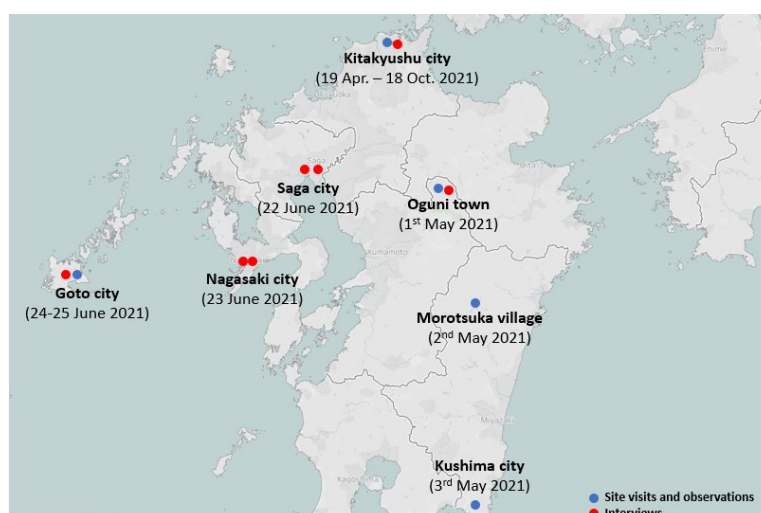


Figure D2. Map of fieldwork activities during the internship. All visited municipalities are committed to ‘Zero Carbon City’.

Location	Fieldwork activity
Kitakyushu city, Fukuoka pref.	• Interview with the former director of the Environment Bureau of Kitakyushu city (I1) • Interview with the chair of the council for promotion of Yahata-Higashida District development (I2) • Site visit of the Eco Town’s Next Generation Energy Park (Hibikinada Wind Power Generation Project) (S1) • Site visit of the city district “Bonjono” – Kitakyushu’s sustainable residential district with low-carbon housing (S2) • Site visit and an interview with the director of “Omoyai Farm” (a local horticulture social business start-up inspired by the SDGs) (I3) (S3) • Observation of citizen engagement at the Citizen Center (a workshop on organic waste composting organized by the Kitakyushu City Hall) (O1)
Oguni town, Kumamoto pref.	Site visit and interview with a member of the local community who runs a small hydroelectric power plant (I4)(S4)
Morotsuka village, Miyazaki pref.	Site visit of the sustainable forestry practice project, contributing to carbon sink (S5)
Kushima city, Miyazaki pref.	Site visit of an offshore wind farm (2.85MW x 23 units) (S6)
Saga city, Saga pref.	• Interview with the local government officials from Saga City Hall (environment bureau) (I5) • Interview with the prefectural government officials from Saga Prefecture Hall (environment bureau) (I6)
Nagasaki city, Nagasaki pref.	• Interview with the local government officials from Nagasaki City Hall (environment bureau) (I7) • Interview with the prefectural government officials from Nagasaki Prefecture Hall (environment bureau) (I8)
Goto city, Nagasaki pref.	• Interview with the local government official from Goto City Hall (Renewable Energy Promotion Section) (I9) • Interview with the director of the Goto Citizens Electric Power Company (a local energy company established and managed by local stakeholders) (I10) • Interview with the director of the Marine Renewable Energy and Fisheries Institute (a locally based institute conducting research on marine environment and co-existence between marine environment, fishery and offshore wind power development) (I11)

Table D1. List of fieldwork activities and corresponding codes assigned for each activity

3.3 Summary of Fieldwork Findings

3.3.1. Exploring conducive background for ‘Zero Carbon City’ declarations and examples of municipal initiatives towards net-zero emissions.

A) Historical and socio-economic background (Case: Kitakyushu city)

Local context and historical background play a decisive role in how local governments approach climate action. For instance, Kitakyushu city is a famous case of a municipal environmental action in Japan, recognized both domestically and abroad (OECD, 2013; OECD, 2021). As one of the major industrial centers of Japan’s post-war economic miracle, the city suffered from severe water and air pollution up until

the 1970s-80s when substantial measures were taken to curb pollution (Lin, 2018). These measures were focused on technological interventions, such as improved cleaner industrial processes and technology (i.e. “hardware” approach), as well as stricter environmental regulations for major polluting industries (Naito, 2017). Combating industrial pollution through development and implementation of cleaner industrial technology helped to cement the city’s focus on “hardware” approach to environmental and climate measures. In 1997 Kitakyushu city created Eco-town – an industrial hub of recycling industries (cars, plastics, etc.), which in addition to dealing with waste has also been promoted as contributing to the reduction of carbon emissions (as a result of waste reduction) (Yin, 2014).

Heavy industries (e.g., steel works, chemical industry, car manufacturing) have been at the core of Kitakyushu city’s economy since its very foundation. These industries are also the city’s main contributors to environmental pollution and GHG emissions. Therefore, the city government has been working closely with the city’s major industries in order to respond to citizens’ demand to curb pollution, while simultaneously maintaining industrial production and economic growth (I1). Additionally, Kitakyushu city has a population of roughly 1 million, and thus has the status of ordinance-designated city. This designation allows the city government to communicate directly with the national government (I1). Historically, mayors of Kitakyushu city have acted as a ‘strong pipe’ between the city government and the national government ministries (especially with the METI), while also maintaining strong ties with the heavy industry sector companies operating in the city (I1). Supported by both the central government and large industry actors, Kitakyushu city has been often a testbed for various experimental mega-projects. Given the city’s history of tragic pollution and the city’s pride in overcoming it, these mega-projects have mostly focused on environmental technology.

One such example is the iconic Eco-town, which was developed through government subsidy and investment from steel industry (I1). Its main investor and shareholder was Shinnitetsu [Nippon Steel] - a steelworks corporation based in Kitakyushu. In the late 90s the steel industry in Kitakyushu declined due to shrinking market share of Japanese steel and cheaper production in developing countries (I1). With

the decline in the city’s backbone industry, it was necessary to create new employment opportunities, while making the best use of the existing skills and knowledge of steelmaking (I1, I2). Therefore, in order to diversify its business, to create jobs for former steel workers and to utilize the vacant industrial land, Shinnitetsu, together with government backing, invested and developed two mega-projects – SpaceWorld (an entertainment roller-coaster theme park) and Eco-Town (an industrial cluster of recycling industries) – both built on vacant, former steel factory land (I2). SpaceWorld was aimed at creating service-based employment, while the latter project focused on technology-based employment (I2).

The history of citizen activism and subsequent environmental policy being part and parcel of the city’s historical narrative, resulted in the development of Eco-Town, as well as the city’s adoption of several national government’s consecutive policy frameworks, such as Eco-Model city, Future City and SDGs Future City. These initiatives culminated in the city’s announcement of its intention to achieve net-zero CO2 emissions by 2050 (i.e. the ‘Zero-Carbon City’ declaration).



Photo D1. Eco-town Next Generation Energy Park. Source: author

Given the ambitiousness of the plan, Eco-Town itself could not provide drastic reductions of CO2 necessary for net-zero goal. In order to maintain its reputation as an ‘environment leader’, the city had been following up with other measures, mainly through similar mega-project model, focusing on technology and employment creation for former steel industry workers. The most recent and ambitious project currently in the making is the development of an offshore wind power farm, coupled with the creation of the wind power industry hub, named Green Energy Port Hibiki, in the city’s port area. In addition to harboring a highly specific ship fleet for transportation and assembly of offshore wind turbines, the port hub will have various facilities specializing in the production and maintenance of periphery parts for offshore wind power. The port hub will serve as main base for wind turbine raising and maintenance in the Kyushu region (S1).



Photo D2. Wind turbine maintenance and recycling plant located in the Eco-town. Source: author.

Another mega project was developed to utilize the 19-hectare vacant land north of JR Jono Station after the relocation of a Self-Defense Forces camp and as part of a plan to reconstruct a former public housing estate (MLIT, n.d). This large redevelopment project aimed to create of an eco-friendly housing district, adding to the value and appeal of the area through the introduction and utilization of various environmental technology systems, such as energy efficient housing, home energy management systems, special pavement materials that reduce the heat island effect, and other technological measures (S2). Ultimately, the project strives for a “theoretical 100% reduction of carbon emissions across the entire district” (MLIT, 2022)



Photo D3. Sustainable residential district BONJONO. Source: au-

Apart from “hardware” (i.e. technology-driven) measures, the city has also been implementing some “software” (i.e. community-driven) measures such as approaching the sustainable waste management through various campaigns focusing on the promotion of “Reduce, Reuse, Recycle” measures. In addition to encouraging citizens to separate garbage, the city government also conducts citizen engagement workshops at Citizen Centers located in every city district. Such engagement activities vary from awareness-raising lectures, picking up street garbage events, to workshops on how to compost organic waste in households (O1).



Photo D4. Attending a citizen engagement workshop at Hibikino Citizen Center. Source: author



Image D1. Composting workshop image

Except for companies involved in the megaprojects described above, little evidence could be found of the city engaging the private sector (especially small-medium enterprises, or SMEs) in climate action. However, some entrepreneurs in the city appear to have been inspired by the city’s SDGs Future City status and have taken action independently from the city. One example is “Omoyai farm” - a small, urban horticulture business, which provides employment to people with disabilities (O1).



Photo D5. Urban horticulture social business. Source: author



Image D2. Company logo Source: <http://omoyai.co.jp/farm>

B) Geography and local resource endowments (Cases: Oguni town, Morotsuka village, Kushima city)

In other municipalities, the geographical context and resource endowments have been the impetus for climate action. In Oguni town of Kumamoto prefecture (population 8,735), a large (137 km²), sparsely populated area comprising mainly hilly and forested land, the municipal government, together with local community, has been adapting local traditional resource management practices to mitigate climate change and revitalize the area. One such example is the installation of a small hydropower plant in an irrigation channel that have been previously used to deliver water to a nearby rice field (I4, S4). This renewable energy generation project received investment from and is managed by local community (I4, S4). The power lines are connected to the major electricity grid, allowing the community to sell the electricity to the electric utility company (Kyushu Power Inc.) through the Feed-in Tariff²³ scheme and to use the revenue for the community's needs (I4, S4). In addition, the municipality promotes its large forest resources as carbon sinks and encourages sustainable forest management practices (S4). Finally, the town partners with other municipalities and businesses to trade carbon credits, where carbon intensive municipalities, such as Kitakyushu city, are able to purchase carbon credits and sustainably produced lumber from Oguni, while Oguni receives financial revenues for supporting its sustainable forest management (Oguni-sugi, 2022)



Photo D6. Small hydropower project run by local community in Oguni town. Source: author

Morotsuka village also has a small population of 1,532 spread over a large administrative area (187 km²), covering vast but barely accessible mountainous area in Miyazaki prefecture. To revitalize the region, the municipality has been promoting its long-established practices of 'combined agriculture and forestry system', as well as its traditional system of 'mosaic' forest management, for which the village has been designated as the Globally Important Agricultural Heritage Systems (GIAHS) by Food and Agriculture Organization of the United Nations (FAO) in 2015 (S5) (Morotsuka HP, 2022). The municipality have made a Climate Emergency declaration in 2020, recognizing the threat to its natural environment and local livelihoods from climate change, while also further promoting its local sustainable practices and products (e.g., FSC -certified wood and forest agricultural products, such as shiitake mushrooms, etc.).



Photo D7. 'Mosaic' forestry in Morotsuka village. Source: Google Maps

Kushima city also capitalizes on its natural advantage of a long and steep hilly coastline along the Pacific Ocean which generates strong winds in order to achieve its climate goals. The city has a population of 17,457 and covers the area of 295km² located on the southernmost tip of Miyazaki Prefecture. With such favorable conditions for harnessing wind power, the municipality hosted a large project development of the onshore wind farm. Consisting of 23 wind turbines, each unit capable of generating 2.85MW of electricity, the total maximum output of 64.8 MW can power 46,000 households (Kushima Windhill HP, 2022) (S6).



Photo D8. 'Kushima Windhill' wind farm.

²³ Feed-in Tariff is a policy mechanism designed to stimulate investment in renewable energy generation by guaranteeing the purchase of electricity at a fixed price over the long term.

The above examples of municipalities illustrate how historical, socio-economic, and geographical contexts are all playing crucial roles in the way that local governments choose their climate measures and strategies. The following examples of two municipal (Saga City, Nagasaki City) and two prefectural (Saga prefecture and Nagasaki prefecture) governments illustrate how the institutional and administrative backgrounds also exert significant influence.

C) Institutional & administrative factors (Saga city; Saga Prefecture; Nagasaki city; Nagasaki Prefecture)

Existing plans and previous actions

Even before the recent trend of declaring net-zero emissions goal gained traction, many municipal and virtually all prefectural governments had already put into place Climate Action Plans (CAP) outlining their intended measures to promote emission reductions. All subnational governments in Japan with a population over 200,000 are mandated to formulate a CAP, while smaller municipalities are not obliged but encouraged to follow suit (Ota & Akagi, 2021). Interviewed government officials from Saga city, Saga Prefecture, Nagasaki city and Nagasaki Prefecture all indicated that the Zero Carbon City declarations were a logical continuation of their existing climate plans and policies, while having an eye on revising these plans to net-zero compatible climate action roadmaps for mid-term (2030) and long-term (2050) (I5, I6, I7, I8).

Peer influence

Another important trigger for net-zero declarations by local governments, especially prefectural governments, has been the announcement by the Prime Minister in October 2020 to set the net-zero target by 2050 for the country as a whole (I6, I8). It cannot be denied, however, that 134 municipalities that made Zero Carbon City declarations before October 2020 had different motivations for their commitments. Some local governments, such as Saga city and Nagasaki city, were inspired by the leading example of peer and neighboring municipalities (I6, I7). Notably, interviewed government officials from Nagasaki city have mentioned that they followed the early example of Kumamoto city, which proactively collaborated with neighboring municipalities and made a joint declaration consisting of 18 neighboring local governments (I7). Nagasaki city also collaborated with 2 neighboring municipalities with which it has strong economic ties and shared infrastructure, making a joint declaration (I7). Municipalities with joint declarations are formulating an integrated joint action plan, rather than individual ones, and try to account for each other's strengths and limitations (I7).

Aspirations and perceived benefits (Local revitalization, Resilience, etc.)

Beyond triggering events, such as net-zero declarations by the nation-state or by peer municipalities, all local governments have deeper motivations for pursuing net-zero goals, mostly related to the perceived opportunities and benefits from the climate action. Initially, via the Zero Carbon City declarations, municipalities were bolstering their image as environmentally engaged city and signaling to domestic and external stakeholders their intent to promote further measures (I6, I7, I8). Ultimately, in this way, municipalities were hoping to improve their reputation as well as attract businesses, investments, expert human resources and new settlers. Through climate action, they hope to create new employment and improve the local economy, increase the resilience of the region against the negative effects of climate change through energy autonomy and self-sufficiency, protect citizens from disasters, among other potential benefits, such as improving citizens quality of life, and so on.

Many of these motivations have been found at play in Goto City of Nagasaki prefecture, during the fieldwork performed by the author between 24th and 25th June 2021 (I9, I10, I11) (Myasoedov & Ota, 2021). A more in-depth investigation of municipalities' motivations to pursue climate action is being conducted by the author in a large-scale survey research of 489 local governments in Japan.

Type of favorable background for net-zero declaration by local governments	Case example
A) HISTORICAL AND SOCIO-ECONOMIC BACKGROUND	
History of dealing with environmental pollution	Kitakyushu city
Strong relationship between the mayor and the national government, allowing to receive budgets for big environmental projects	Kitakyushu city
Domestic and international recognition of the city as an environmental leader	Kitakyushu city
B) LOCAL GEOGRAPHY AND RESOURCE ENDOWMENTS	
Traditional sustainable resource management practices (e.g. forest management)	• Oguni town • Morotsuka village
Favorable geography for renewable energy generation (e.g. strong winds for wind power, water streams for small hydro, etc.)	• Oguni town • Kushima village
C) INSTITUTIONAL & ADMINISTRATIVE FACTORS	
Climate action plans and some climate policies already in place, making net-zero commitment a logical next step	• Saga city • Saga Prefecture • Nagasaki city • Nagasaki Prefecture
Influence from peer local governments	Nagasaki city (inspired by Kumamoto city)
Close ties and shared infrastructure with neighbor municipalities, allowing for collective climate goal setting and pooling resources for initiatives implementation	• Kumamoto city • Nagasaki city
National government's net-zero goal officially announced	• Saga Prefecture • Nagasaki Prefecture
Perceived benefits of climate action inspire local governments to set net-zero goals	Goto city

Table D2. Summary of conducive background factors for net-zero commitments by local governments, based on fieldwork findings.

3.3.2. Challenges

While climate action by local governments is gaining momentum, interviewees from the visited municipalities mentioned numerous challenges to climate action. Despite the forward-looking declarations of intent to achieve net-zero emissions, many municipalities have yet to take concrete actions on that front and are still at the stage of formulating their plans and measures (I5, I7). The general approach for many municipalities has been to first make a political statement, namely Zero Carbon City declarations, – and then start the process of formulating or revising existing plans into net-zero compatible roadmaps for 2030 and 2050 which suit their respective local contexts (Ota & Akagi, 2021) (I5, I7). At this stage, local governments begin to encounter various challenges related to their limited capacity to act, lack of cohesion and cooperation on climate action between the different administrative departments within the municipal government as well as between different levels of government (i.e. national-prefectural-local), and difficulties in engaging a broader coalition of stakeholders.

In terms of limited capacity for climate action, local governments often emphasize the limited number of personnel in the municipal administrations to work on the development and implementation of climate measures, as well as limited budgets available for this purpose (I5, I7). In addition, municipalities have limited data on local emissions, since inquiring every local entity (e.g., local power companies, businesses, etc.) on their emissions and collecting all the data is too burdensome for both local organizations and local administration itself, particularly under current workforce constraints (I5, I7). While approximate estimations of carbon emissions could be made using national data, such estimations are very rough. Moreover, without local data it is difficult to make definitive statements on whether the change in the city's emissions

amount can be attributed to a particular policy implemented by the city or such change resulted from other factors (I5, I7).

Both prefectural and municipal governments often mention issues related to the rigid vertical division between different departments and agencies (so-called *tatewari* in Japanese, meaning ‘vertical division’) within the municipal and prefectural administrations, as well as within the national government (I5, I6, I7, I8). Due to this system, local administration departments are deeply siloed and habitually work within the narrow bounds of their specific sectors, without much coordination and cooperation with other departments. This situation makes it difficult for wide cross-sectoral issues, such as climate action which requires measures related to energy, buildings, transport, land use, consumer behavior and much more, to be effectively tackled through a holistic approach. Not only horizontal, but also vertical coordination and cooperation on climate action between the municipal, prefectural, and national governments have been limited. Interviewed local government officials mentioned that regular meetings between prefectural and municipal officials regarding the climate change policy have not yet been held (I5). As for the prefectural governments, the interviewed officials at prefectural halls tended to point out the important role of national government in leading the climate action agenda forward (I6, I8). They emphasized that the national governments should be more proactive, especially when it comes to infrastructure and technology development (I6, I8).

Another challenge that municipal government officials in charge of climate policy often mentioned was the national government’s inflexible and overly complicated process of subsidy application (I5, I7). While numerous subsidy programs exist, they are difficult to obtain and utilize due to the stringent conditions attached, e.g. to show substantial results within short period of time; to have clear project plans in place before the application; etc. (I5, I7). Municipal governments hope that the subsidy scheme would be made more easier to apply, less strict in terms of conditions imposed and available on a more long-term basis (I5, I7).

Finally, both municipal and prefectural government officials highlighted the importance but also the challenges related to the process of engaging stakeholders in decarbonization efforts. Since both Saga city and Nagasaki city do not host many heavy industries within their municipal borders, they tended to emphasize the challenge of involving SMEs and households in emission reduction measures (I5, I7). Prefectural governments emphasize challenges related to reduction of emissions from large energy-intensive businesses operating within the prefectural borders, as well as the difficulty of involving large energy utilities without the necessary regulatory frameworks from the national government (I6).

Government officials and local stakeholders in Nagasaki prefecture often mentioned the need to carefully consider impacts on ocean environment from the wind power development since ocean-related industries are the backbone of local economy and lifestyles. Engaging fishery associations, freight companies and other sea-related stakeholders is crucial for the sustainable development of wind power in the area (I8, I9, I11). Moreover, local governments have to consider compliance with various non-government environment conservation organizations such as UNESCO World Heritage, Important Bird and Biodiversity Areas (IBAs) and others that have active protection treaties in the area (I7, I9).

3.4 Conclusions from the fieldwork

In summary, the fieldwork has uncovered the following important points: first, the recent net-zero declaration trend has been in fact a part of the ongoing effort by municipalities to address climate change,

Challenges for effective climate action by local governments
A) LIMITED CAPACITY OF THE LOCAL GOVERNMENT TO TAKE EFFECTIVE CLIMATE ACTION
Limited number of staff in the local administration
Limited budgets are earmarked for climate action in local governments
The data on local carbon emissions is hard to obtain and manage
B) ISSUES OF COORDINATION AND COOPERATION WITHIN AND AMONG GOVERNMENT LEVELS
Rigid vertical division (<i>tatewari</i>) among local governments administrative departments hinders horizontal coordination and cooperation on multi-sectoral issues, such as climate change
Coordination and cooperation along the vertical axis of government (i.e. nation-prefecture-municipality) necessary for effective climate action is lacking
Insufficient guidance and policy frameworks by the national governments
Inflexible and inefficient national subsidy application process
C) ISSUES RELATED TO STAKEHOLDER ENGAGEMENT
Involving SMEs and households in carbon emission reduction initiatives is challenging
Involving large corporations (e.g. large energy utility companies) is difficult for local governments without necessary regulatory frameworks by the national government

Table D3. Summary of challenges for effective climate action by local governments, based on fieldwork findings

which in different municipal contexts, depending on various historical, geographical and socio-economic backgrounds, has yielded different patterns of climate measures by local governments. The environmental policy continuity, peer pressure from other municipalities and net-zero declaration by the national government have all contributed to triggering the ‘domino effect’ of net-zero declarations. While these factors have been important for motivating the declaration of Zero Carbon cities, ultimately a set of various deeper motivations related to perceived opportunities that can be yielded from the climate action (e.g. regional revitalization, improved resilience, quality of life, etc.), has played an important role in realizing climate action.

Currently, after the political statements have been made, sub-national governments now have to face and grapple with various challenges related to limited capacity for action, as well as insufficient institutional (horizontal and vertical) and multi-stakeholder cooperation and collaboration. A more detailed empirical case based on interviews and observations conducted by the author in the Goto city of Nagasaki prefecture has been consolidated in a booklet, which was peer reviewed and published as an open-access article on IGES website, representing a contribution by the intern to the host organization and the society (Myasoedov & Ota, 2021).

4 Project-Based Research (PBR) - International Forum on Zero Carbon Cities

4.1 Background

As part of the doctoral research, the author implemented a survey of local governments in Japan (Zero Carbon Cities) between June 1st and August 15th, 2022. Of the 489 governments contacted, the author received 309 responses. In order to bring a transdisciplinary dimension to the research by receiving feedback on the preliminary research results and input from multiple stakeholders to guide further analysis, the author has organized and implemented an international forum with the title “ZERO-CARBON CITIES:

Opportunities, Challenges, Solutions” (Fig. 3).

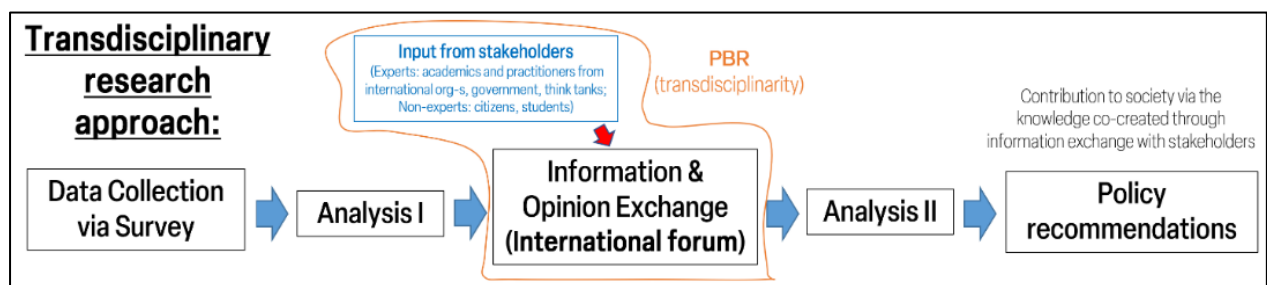


Figure D3. Position of the PBR in the research design. Source: author

4.2 PBR implementation

The purpose of the forum was to exchange opinions between stakeholders and discuss the following topics: how and why municipalities are attempting to achieve the goal of net zero emissions by 2050? What challenges do they face towards this goal? What could be some possible solutions? The forum gathered an expert panel of five speakers and three commentators (a total of 8 discussants) which included officials from **city governments (Kyoto and Kobe)**, representatives of the **Institute of Global Environmental Strategies (IGES)** and the global city network “**ICLEI – Local Governments for Sustainability**”, and academics from **Tokyo University, Kyoto University, Federal University of Parana, Brazil, and Bandar Lampung University, Indonesia**. The core presentation was delivered by the author, covering the preliminary results of his original survey research on municipalities’ motivations and barriers towards achieving net-zero carbon emissions by 2050 (Table D4).

The forum was conducted on 19th October 2021, in hybrid format and was attended by 60 attendees (45 online and 15 at the venue) from 17 countries (fig. D4). At the Q&A session panelists received and responded to 3 questions from the on-site attendees, and 3 questions from audience on-line (in total, 18 questions were submitted via on-line). A follow-up to the forum was conducted between the 20th and 31st October, 11 days after the forum’s implementation. In the follow-up, a total of 30 questions (16 from the audience and 14 from the moderators) were forwarded to corresponding discussants (fig.D5). The responses to all questions from all discussants were collected and organized in a summary document which was shared with all attendees.

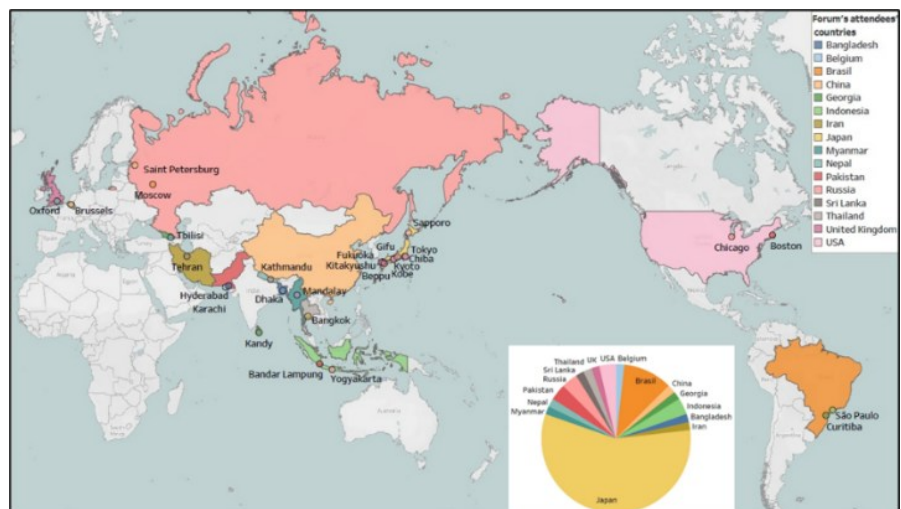


Figure D4. Countries and cities of the forum’s attendees. Source: author

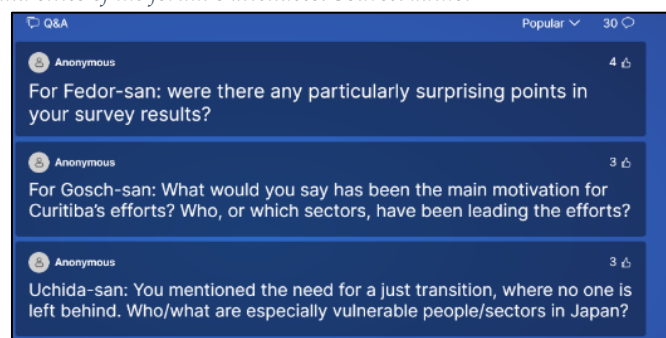


Figure D5. Questions submitted online at the forum. Available at: <https://app.sli.do/event/sQzDk6ZMaRtvibTEbhFM7R>

Level	N	Discussants	Organization / Affiliation	Contribution (Presentation topic)	Stakeholder group
Global	D1	Yasuko Kameyama	- Deputy director at the Center for Social and Environmental Systems Research at the National Institute for Environmental Studies (NIES); - Professor at the University of Tokyo	The Big Picture of Net-Zero	- National government's research center - Academia
	D2	Togo Uchida	Executive Director of ICLEI Japan	Commentary from the perspective of international organization	International NGO - global network of local governments
National level (Japan)	D3	Fedor Myasoedov	PhD candidate at the Graduate School of Advanced Integrated Studies in Human Survivability (GSAIS), Kyoto University	Municipalities' Motivations and Challenges of Achieving Net-zero Emissions by 2050: Original Survey Summary of 309 Local Governments in Japan	Academia; survey investigator
City level (Japan)	D4	Kikuta Shoichiro	Chief of the Planning Division at the Global Warming Countermeasures Office, Environmental Policy Bureau, Kyoto City Government	Kyoto City's Challenge to Net Zero by 2050	City government, Environment Bureau Authority
	D5	Aoi Michito	Assistant Manager at the Port and Harbor Planning Division, Port and Harbor Bureau, Kobe City Government	Kobe Port's Efforts Toward a Carbon Neutral Port (CNP)	City government, City Port Authority
City level (International)	D6	Alessandra Gosch	- Civil engineer (city planning, traffic management, urban environment) in Curitiba city, Brazil. - PhD student at Federal University of Paraná (UFPR) in Curitiba, Brazil.	Lessons From the Best Practices of Curitiba: A Pioneering Sustainable City in Brazil	- City Planners, - Academia (Brazil)
	D7	Fritz Akhmad Nuzir	- Assistant professor (Architecture and Engineering) at the Universitas Bandar Lampung (UBL) - Director of UBL Center for SDGs Studies	Commentary from the perspectives of Indonesia, Bandar Lampung city and Architecture	- Architects, - Academia (Indonesia)
Community level	D8	Junko Ota	- Policy researcher at Kitakyushu Urban Centre (KUC) of the Institute for Global Environmental Strategies (IGES), Kitakyushu city, Japan - Educator and designer of dialogues and workshops for the local stakeholders	Commentary from the perspective of community engagement	- Regional Research Center - Facilitators of citizen dialogues and workshops
	A1	Audience	Wider public (from 17 countries)	Questions to discussants	Students (youth), Citizens, etc.

Table D4. International forum participant structure

Furthermore, to uncover more insights from the information shared in the forum, a qualitative content analysis has been performed. The forum was transcribed into a text document, which together with the Q&A summary document obtained through follow-up, comprise a document of 14700 words (26 A4 pages). This text document has been analysed with the qualitative analysis software MAXQDA to find out the most frequently used word combinations (fig.D6). These word combinations reflect the main sentiment and topics of concern for



Figure D6. Word cloud of the most frequently used word combinations at the forum. Source: author

participating stakeholders, which includes both experts (speakers & commenters) and non-experts (audience).

4.3 Summary of the international forum

Perceived at the global level, there are both an ambition gap (i.e. announced targets are not enough to keep global warming under 1.5C), and an action gap (i.e. measures taken in practice are not sufficient to achieve the announced targets) in regards to nation-states' climate action (D1). As international negotiations remain in gridlock and as national governments find it difficult to move the climate policy agenda forward, the role of non-state actors (e.g. local governments, businesses, households) is coming to the forefront (D1). The international community (e.g. COP²⁴, G7) and central governments (e.g. Japan, US, EU, etc.) increasingly recognize local government as a key institution to deliver zero-carbon goals (D2). As remarked at the forum by the representative of the international NGO ICLEI Japan (D2), this recognition is *"a global phenomenon that is happening right in front of our eyes now"*. Moreover, local governments' actions have an impact on national governments' policy (D2). For example, in Japan, some local governments have acted first with their net-zero announcements and concrete projects, while the national government have joined the net-zero movement at the later stage (D1, D2).

The survey conducted by the author in Japan with responses from 309 local governments have revealed that the major motivations of local governments for pursuing net-zero are the perceived benefits and improvements in such dimensions as the local economy, resilience, security, quality of life and bolstering the city's image (D3). Discussants from ICLEI (D2) and Bandar Lampung University in Indonesia (D7) noted that these major motivations are likely to be similar in other countries' contexts as well. Some distinction, however, can be perceived in the hierarchy of importance given to each of those motivation groups. A speaker from Indonesia reflected, that in his country, improving the city brand would likely be the next most important after the motivation of improving local economy (D7).

A policy researcher from IGES (D8), speaking from her experience as both a national representative of Japan's delegation at COP and a facilitator of local level citizen engagement activities, commented that it is important to keep in mind that motivations vary for different actors at different administrative levels. National and local governments tend to be moved by motivations that aim at yielding long-term and collective benefits, while local stakeholders (e.g. citizens, households, SMEs, etc.) are more driven by short-term and individual benefits (D8). In addition to this understanding, it is important to identify and clarify the motivations behind major actors, since motivations can reference major opportunities (i.e. perceived benefits), the prospects of which stimulate stakeholders to take action toward achieving the goal (D3, D8). Promoting these opportunities can help persuade stakeholders to take action. Moreover, treating climate action as an opportunity with benefit prospects (positive thinking), rather than a burdensome obligation (negative thinking) helps reduce tensions and bridge gaps among stakeholders at all levels (D8).

During the forum, representatives of the city governments (Kyoto and Kobe) presented some of their initiatives toward net-zero. Proclaiming the period between 2021 and 2030 the "decade of action", Kyoto city is committed to taking necessary measures to achieve its emission reduction targets of 46% by 2030 (compared to 2013 level) and net-zero by 2050 (D4). The city has been implementing various initiatives

²⁴ Conference of the Parties (COP) at the United Nations Framework Convention on Climate Change (UNFCCC) - the supreme governing body, composed of representatives of the member states of the convention and accredited observers.

such as the promotion of energy savings and waste reduction measures among households and businesses; the promotion of renewable energy instalments in buildings through regulatory and encouragement mechanisms, which are mandatory for buildings over 2,000 m² and recommended for smaller-scale buildings; the creation of energy revenue circulation schemes via the issuance and usage of local currency points; the creation of platforms for citizen engagement and co-creation of new experimental climate initiatives; widening pedestrian streets in the city centre; and other measures (D4).

One of the major initiatives by Kobe city is the development of the Carbon Neutral Port (CNP) by focusing on various decarbonisation measures in the city's port area (D5). One such example changes the power for ships from the on-board heavy oil burning generators to powering ships with electricity supplied from the shore at the port (D5). This measure, in addition to reducing emissions from the shipping industry, also yields various co-benefits such as improved health and quality of life of the ship crew due to reduced noise, vibration and gas exhaust from the on-board generators powered by fossil fuels (D5). One of the main initiatives of CNP is the creation of a hydrogen fuel supply chain by using port infrastructure (D5). Port facilities will be used for receiving liquified hydrogen fuel from overseas (e.g. Australia), as well as for hydrogen storage and the establishment of infrastructure for distribution to consumers in the city (D5). The initiative is currently under development, and an integrated plan is being developed by the port authorities in consultation with local stakeholders, such as companies working in the port territory, national government ministries (especially METI) and academics (D5). In addition to the major initiatives described above, port authorities have also experimented with other initiatives. One example is the project of replanting seaweed in the port's waters to increase carbon sinks (D5). However, the initiative should be expanded to include the mechanism for removing and processing of dead seaweed, since its decomposition will release carbon back to atmosphere, as was pointed out by a comment from the audience (A1).

Curitiba city, located in the state of Parana in Brazil, is a well-known case of pioneering municipal efforts toward sustainability. The city of 1.8 million residents has been reported to have the best air quality in Central and South America in 2022, greatest achievement of the SDGs in 2021, and the greenest city in Latin America in prior years (D6). The forum's discussant from Curitiba (city planner, academic, citizen) (D6) shared some reflections on the city's motivations and success factors. Curitiba was originally facing many of the typical challenges of a rapidly growing city in a developing country, with issues such as an extremely limited municipal budget, lack of technological know-how and infrastructure, rapidly growing population, and deterioration of air quality (D6). Partnership between the city council and the urban planning institute has resulted in an integrated approach that was focusing on moving forward measures that are feasible, affordable, effective, and that yield multiple benefits (D6). For example, the city's pioneering and most celebrated initiative – Bus Rapid Transit (BRT) system – brought improvements in air quality, urban accessibility, transport affordability, and social mobility, in addition to reducing traffic. In parallel, the city has been promoting basic environmental education which has not only helped with implementing measures (e.g. household waste separation), but also helped achieve better consensus and common vision for the city's development pathway among various urban stakeholders (D6).

While the case studies shared at the forum by cities' representatives were useful to clarify how and why cities are attempting to achieve net-zero emissions, it was equally important to discuss the challenges towards net-zero goals. The most common challenges were identified and ranked by the author (D3) through the survey research of local governments in Japan, the results of which has been shared at the forum.

Most municipalities lack the capacity to act effectively on climate due to budget restrictions, lack of authority and few climate-policy specialists in local administrations (D3). The forum's discussant from Bandar Lampung city in Indonesia (D7) confirmed that the same challenges are also acute in Indonesia. Reflecting on his personal experience of working with local governments, he emphasized issues of insufficient expertise in local administrations and difficulties in obtaining local emissions data (D7). While the survey reported that budget constraints of local governments were one of the most common and widespread barriers to climate action (D3), some important nuances to this issue were uncovered during the opinion exchange between experts at the forum. As noted by the ICLEI representative (D2) – *“Slowly but surely, money seems to be flowing towards (climate) projects and to local governments. But how municipalities can best utilize the funds is obviously the question”*. Since environmental departments replied to the survey, it *“doesn't mean that local government itself is lacking the budget, but environment departments are lacking budgets”* (D2). Other departments (e.g. economic department, infrastructure department, etc.) also conduct various projects related to climate, in the example of Kobe city CNP initiative; thus, *“many projects can be actually implemented within the actual budget that have been already distributed at this point”* (D2). The issue of budget constraints, therefore, may in fact be a reflection of another common challenge – the lack of coherent coordination and cooperation on climate action between various administrative departments (D2, D3, D7, D8). Climate action must be discussed not as an environmental issue alone, but also at the economic policy level and social policy level (D2). While many issues exist regarding the lack of unified vision and difficulties in building consensus on climate action (D3), many challenges could be addressed through *“enhancing vertical, horizontal and multi-stakeholder collaboration”* (D2).

The process of engaging stakeholders and building consensus is challenging for local governments (D3, D4), but indispensable to enacting efficient policy. Particular attention should be given to *“involving the real people on the ground, without which zero carbon goals cannot be achieved”* (D8). Attention to engaging citizens in the “1.5C lifestyle” is gaining traction as an integral part of the solution towards achieving net-zero goals by municipalities (D2, D8). In addition, more attention should be given to *just transition*, meaning considering and engaging vulnerable groups of stakeholders and sectors that will be the most affected in the process of transition to net-zero (D2). Such stakeholders include employees of carbon-intensive heavy industries and SMEs that supply products to these big industries (D2). In general, people who are already vulnerable (e.g. marginalized communities, indigenous people, people of low social status, people living in isolated geographies, etc.), will be more affected than those who are wealthy (D2). It is therefore an important part of the governments' work toward net-zero to ensure that social safeguards are in place (D2).

The analysis of the questions posed to the forum's discussants by the audience revealed that significant concern from the public is directed at such issues as raising climate consciousness, provision of basic environmental education, synergies between climate policies and SDGs, role of non-governmental actors (including the youth), issues of just transition and the role of climate activism (A1) (fig. D6).

4.4 Conclusions and social significance of the PBR

The international forum succeeded in achieving a wide horizontal (multi-sector) and vertical (multi-level) representation of expert stakeholders, having gathered 8 discussants, as well as wide participation by the audience (60 attendees) (table 2). Both the speakers and the audience represented a broad variety of countries (fig.4). Thus, the forum was effectively an international, multi-level and multi-stakeholder platform for knowledge exchange, discussion and awareness raising, in which both experts (discussants) and

non-experts (audience) interacted. The forum’s social contribution was three-pronged as it allowed for mutual learning between experts and the public, through multi-level and international knowledge sharing and though engaging stakeholders in academic research (fig. D7).

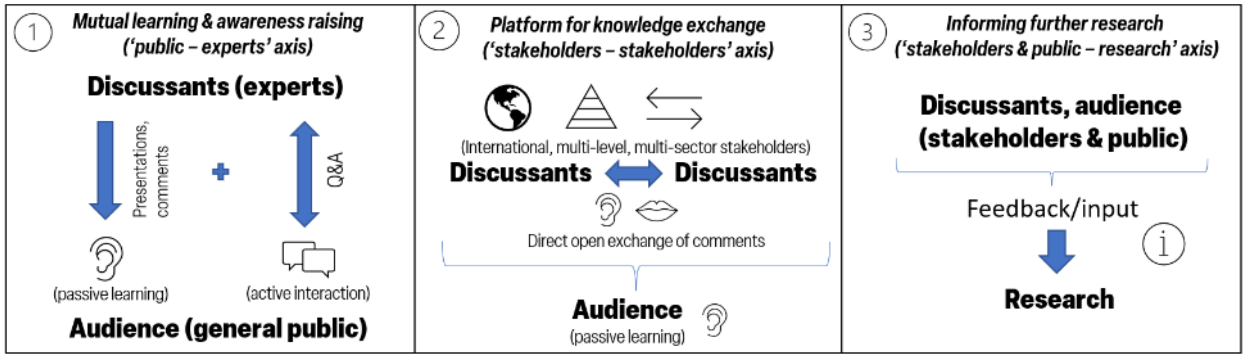


Figure D7. Three-pronged social contribution of the PBR. Source: author

First, the forum contributed to mutual learning and awareness raising. People in the audience had an opportunity to learn about the current situation of ‘net-zero’ from various experts, not only by passively listening but also by posing questions. On the other side, the discussants themselves (especially the cities’ representatives) got a sense of demand and interest from the public regarding climate policy. In total, 32 questions were posed to discussants.

Second, the forum served as a platform for knowledge exchange where representatives of various sectors at various levels and different countries had an opportunity for peer learning. Many stakeholders are currently at the stage of formulating their course of action for contributing to a net-zero pathway, but they still do not know how exactly they should act. The forum facilitated an opinion and knowledge exchange between participants about the opportunities and challenges associated with net-zero, as well as learning lessons from the experiences and best practices of cities in Japan, Brazil, and Indonesia.

Finally, as was intended by the transdisciplinary research design, the forum provided an input from stakeholders into the author’s future research. In addition to direct feedback from discussants on the survey performed by the author, this input also comes from an analysis of questions from the audience and answers by discussants, which was performed in the follow-up to the forum. The qualitative analysis performed on inputs from both experts (discussants) and non-experts (audience) provided important insight on the general sentiment and themes that concern wide range of stakeholders on the net-zero issue. Considering the above points, the PBR was a successful exercise, both in contributing to society and in informing further research.

5. Other action research contributions

5.1 Organizing a study webinar “Russia’s NDC under the Paris Agreement: An Overview of Russia’s Policy and Politics of Climate Change”

Despite being the world’s 4th largest GHG emitter, not much information is available in English language concerning how the issue of climate change is perceived and addressed in Russia. As a contribution to filling this gap in knowledge, the author, using his knowledge of native Russian language, performed exploratory desk research on this topic and shared the results by organizing a study webinar where he delivered the keynote presentation in English. The webinar touched upon topics such as the status of Russia’s nationally



Figure D8. IGES Study Webinar - “Russia’s NDC under the Paris Agreement”. Available at: https://youtu.be/_2d81aa5Kjo

determined contributions (NDC) under the Paris Agreement, the role of Russia’s forests in global carbon sinks, Russia’s motivations for climate action and risks of no action, and current initiatives, including pilot net-zero regions. The webinar was held in the format of a dialogue between the keynote presenter (author) and the facilitator (Ms. Junko Ota from IGES). Final comments were delivered on-line by a special guest, chair of the Russia’s Green Building Council in Moscow. Having a wide participation of around 50 persons from 12 countries, the webinar was a valuable step in increasing the understanding of the situation regarding climate change in Russia by the international audience and by the audience from Russia (fig.D8).

5.2 Attending a public hearing on the release of the *Kitakyushu City Global Warming Countermeasures Action Plan* draft and submitting the comments on the plan to the city government

The author attended the public hearing on the release of the plan’s draft and observed the work of the Kitakyushu City’s Environmental Council (fig. D9) (Kitakyushu City, 2022). The council consists of pre-selected representatives of the city’s major stakeholder groups in academia, industry, civil society, etc. After the public hearing, the author developed possible improvements for the plan by comparing it with notable climate action plans by other proactive global cities (e.g. Portland, Stockholm, Vancouver, Ann Arbor, etc.). Based on such comparison, concrete improvements to the plan were suggested:

- Clarifying the co-benefits related to the implementation of the plan
- Including an explanation on how the plan was developed and how stakeholders were involved at each stage of the plan’s development
- Including a summary table outlining the actions to be taken to achieve the goals outlined in the plan. Preferably the table should include: estimated costs of implementation; potential GHG reduction value; associated co-benefits; actors responsible for implementation; success/failure indicators; target population.
- Creating a website which contains regularly updated information about the plan and its implementation.

The comments above, together with excerpts of specific examples from the other notable cities’ climate action plans, were submitted to the Kitakyushu city hall via the Public Comment System, thus representing an act of civic participation by the author. The author hopes that by making the policymakers consider his comments, he may have contributed to the city’s climate policymaking as an active citizen.

5.3 Raising awareness on SDGs by organizing the “2030 SDGs Game”

To raise awareness on SDGs among the youth (university students) and the general public, the author organized an event, the “2030 SDGs Game”, by inviting a professional facilitator (Ms. Junko Ota from IGES) to hold the game at Kyoto University (photo D9). The 2030 SDGs Game is a multiplayer, in-person, card game that simulates taking the “real world” into the year 2030. The game was designed in Japan in 2016 and has become a powerful and impactful social phenomenon, earning extensive media coverage, and reaching over 150,000 participants (2030 SDGs Game, 2022). Players interact with each other and implement projects to achieve their goals by the end of the game. At the same, time players shall strive to maintain a balanced ‘sustainable’ world in which 3 pillars of sustainable development, Economy, Environment and Society, are in harmony. By playing this game, participants learn how the world is intricately impacted by the people’s enmeshed value systems and resources. The 2030 SDGs Game is a rigorous educational tool that helps participants experience the underlying principles of the SDGs.

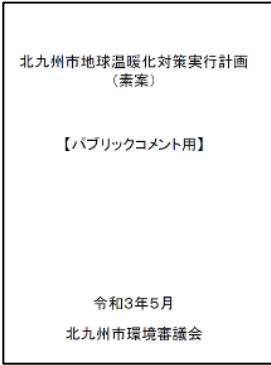


Figure D9. *Kitakyushu City Global Warming Countermeasures Action Plan* draft (Kitakyushu City, 2022).

A diverse team of 13 participants from 8 countries successfully visualized a sustainable 2030 world through active collaboration and communication. The author believes that this event was a useful exercise to re-establish the trust and the connection between the youth and the SDGs, especially in light of the growing skepticism toward achieving SDGs due to recent multiple setbacks such as the coronavirus pandemic, military conflicts and other unsettling events. By approaching the topic of SDGs from a more engaging and entertaining angle through a game, rather than the ‘dry’ academic approach, the participants find it easier to understand the underpinnings behind the concept and renew their interest in SDGs. The positive feedback from the participants, provided privately to the author after the game, confirmed that the game has been successful in catalyzing conversations among the youth on the SDGs.



Photo D9. 2030 SDGs Game at Kyoto University. Source: author

6. Conclusion

The research design behind this working paper experimented with mixing various methodologies in order to bring the *transdisciplinary* element to the research, as well as to make a direct contribution to society during the process of the research. According to the author’s understanding of transdisciplinary, and based on the existing literature (e.g. Wittmayer, 2014; Renn, 2021) the author attempted various *action research* and engagement approaches (e.g. participatory action research, stakeholder engagement, activism, etc.) through a range of activities:

- acquiring a job at the organization embedded in the research field (i.e., internship)
- organizing knowledge exchange and engagement events among stakeholders (e.g., international forum and study webinar)
- contributing directly through such activities as awareness raising (e.g., organizing SDGs Game) and citizen participation in policymaking (e.g. submitting public comments to the city government).

The results yielded through the research range from the creation of new knowledge (see the fieldwork and PBR summary) to the direct impact on the society (through activism and civic participation). More impact is expected to be generated in the future, by publishing the results of the survey research and sharing the policy recommendations with the municipal policymakers (e.g. environment bureau officials) and academics.

7. References

- Climate Action Tracker website, CAT Emissions Gap (accessed Dec. 2022). <https://climateactiontracker.org/global/cat-emissions-gaps/>
- Gudde, P., Oakes, J., Cochrane, P., Caldwell, N., Bury, N. (2021). The role of UK local government in delivering on net zero carbon commitments: You've declared a Climate Emergency, so what's the plan? *Energy Policy*, Volume 154, 2021, 112245, ISSN 0301-4215. <https://doi.org/10.1016/j.enpol.2021.112245>
- Kitakyushu City (2022, August 16). 北九州市地球温暖化対策実行計画について [Kitakyushu City Global Warming Countermeasures Action Plan]. 環境局グリーン成長推進部グリーン成長推進課 [Green Growth Promotion Section, Green Growth Promotion Department, Environment Bureau]. https://www.city.kitakyushu.lg.jp/kankyoku/002_00008.html
- Kushima Windhill HP, 2022 (accessed 2022, 28th Dec). Main page. <https://www.k-windhill.co.jp/>
- Lin, Z., 2018. Ecological urbanism in East Asia: A comparative assessment of two eco-cities in Japan and China. *Landscape and Urban Planning*, Volume 179, 2018, Pages 90-102, ISSN 0169-2046, <https://doi.org/10.1016/j.landurbplan.2018.07.008>.
- Ministry of the Environment, Government of Japan (2022, December 27). *State of declaration of net zero carbon dioxide emissions in 2050 by local governments* (地方公共団体における 2050 年二酸化炭素排出実質ゼロ表明の状況). <https://www.env.go.jp/policy/zerocarbon.html>

- Ministry of the Environment, Government of Japan (2022, December 27). *Efforts toward net zero carbon dioxide emissions by 2050* (2050 年二酸化炭素排出実質ゼロに向けた取組等). <https://www.env.go.jp/content/000090727.pdf>
- Ministry of Land, Infrastructure, Transport and Tourism (MLIT), 2022 (accessed 2022, 27th Dec). *BONJONO. District of the Future for Everyone*. <https://www.mlit.go.jp/common/001222371.pdf>
- Morotsuka village HP, 2022 (accessed 2022, 28th Dec) 世界農業遺産の認定「山間地農林業複合システム」[Globally Important Agricultural Heritage System "Mountain Agriculture and Forestry Complex System"] <https://www.vill.morotsuka.miyazaki.jp/giahsmorotsuka>
- Myasoedov, F., Ota, J. (2021). Pathway to a Zero Carbon City: Island of Energy, Goto City, Japan. IGES. <https://doi.org/10.57405/iges-11816>
- Naito, H. (2017). 北九州市の環境政策 ―大気汚染問題を中核に― [Kitakyushu's Environmental Policy - Focusing on Air Pollution Issues]. In 「日本環境問題: 改善と経験」 [Environmental Issues in Japan: Improvements and Experiences (Chapter 3)]. 社会科学文献出版社・笹川平和財団日中友好基金 [Publisher: Social Science Literature, Sasakawa Peace Foundation Japan-China Friendship Fund]
- OECD (2013), Green Growth in Kitakyushu, Japan, OECD Green Growth Studies, OECD Publishing, Paris, <https://doi.org/10.1787/9789264195134-en>.
- OECD (2021), "A territorial approach to the Sustainable Development Goals in Kitakyushu, Japan", OECD Regional Development Papers, No. 15, OECD Publishing, Paris, <https://doi.org/10.1787/12db268f-en>.
- Ogunisugi, 2022 (accessed 2022, 28th Dec) カーボン・オフセット(温暖化対策) [Carbon offset (global warming countermeasures)] <http://ogunisugi.com/activities/carbon-offset>
- Ota, J., Akagi, J. (2021). Commitment to Net Zero Carbon Emissions by 2050 by Local Governments in the Kyushu Region of Japan - Background, Current Situation, and Challenges. IGES. <https://doi.org/10.57405/iges-11193>
- Renn, O. (2021). Transdisciplinarity: Synthesis towards a modular approach. *Futures*, Volume 130, 2021, 102744, ISSN 0016-3287, <https://doi.org/10.1016/j.futures.2021.102744>
- Ruiz-Campillo, X., Castán Broto, V., & Westman, L. (2021). Motivations and Intended Outcomes in Local Governments' Declarations of Climate Emergency. *Politics and Governance*, 9(2), 17-28. doi:<https://doi.org/10.17645/pag.v9i2.3755>
- Sachs J. (2015). The age of sustainable development. Columbia University Press.
- Wittmayer, J.M., Schäpke, N. Action, research and participation: roles of researchers in sustainability transitions. *Sustain Sci* 9, 483–496 (2014). <https://doi.org/10.1007/s11625-014-0258-4>
- Yin G., 2014. Making Process: A Case Study of Eco-Town Project, Kitakyushu City. Article of Special Issue on the 8th Japan-Korea-China Joint Conference on Geography. *Geographical Review of Japan Series B* 87(1): 15–26 (2014)
- 2030 SDGs Game, 2022 (accessed 2022, 28th Dec). Main page <https://2030sdgsgame.com/>