sustainability

Bringing Governance Back Home

Lessons for Local Government regarding Rapid Climate Action

Edited by
David Tyfield, Rebecca Willis and Andy Yuille

Printed Edition of the Special Issue Published in *Sustainability*

www.mdpi.com/journal/sustainability

MDPI

Bringing Governance Back Home—Lessons for Local Government regarding Rapid Climate Action

Bringing Governance Back Home—Lessons for Local Government regarding Rapid Climate Action

Editors

David Tyfield
Rebecca Willis
Andy Yuille

MDPI • Basel • Beijing • Wuhan • Barcelona • Belgrade • Manchester • Tokyo • Cluj • Tianjin

MDPI

Editors

David Tyfield
Lancaster University
UK

Rebecca Willis
Lancaster University
UK

Andy Yuille
Lancaster University
UK

Editorial Office
MDPI
St. Alban-Anlage 66
4052 Basel, Switzerland

This is a reprint of articles from the Special Issue published online in the open access journal *Sustainability* (ISSN 2071-1050) (available at: https://www.mdpi.com/journal/sustainability/special_issues/government_climate_action).

For citation purposes, cite each article independently as indicated on the article page online and as indicated below:

LastName, A.A.; LastName, B.B.; LastName, C.C. Article Title. *Journal Name* **Year**, *Volume Number*, Page Range.

ISBN 978-3-0365-4267-6 (Hbk)
ISBN 978-3-0365-4268-3 (PDF)

Cover image courtesy of Kelly Sikkema

Contents

About the Editors

David Tyfield

David Tyfield is Professor in Sustainable Transitions and Political Economy at the Lancaster Environment Centre (LEC), Lancaster University, and Associate Director of Lancaster's Centre for Mobilities Research (CeMoRe). His research focuses on sustainable transition, especially urban e-mobility and associated infrastructures, including 'ecological civilisation' in China, which he has been studying since 2007. His latest book is *Liberalism 2.0 and the Rise of China: Global Crisis, Innovation, Urban Mobility* (Routledge, 2018) and he is a co-editor of *Mobilities* journal.

Rebecca Willis

Rebecca Willis is a Professor in Energy & Climate Governance at Lancaster Environment Centre, where she leads the Climate Citizens project. In 2020 she was an Expert Lead for Climate Assembly UK, the Citizens' Assembly established by the UK Parliament. Rebecca is a Trustee of the New Economics Foundation and an adviser to the National Lottery's Climate Action Fund. Previously, she was a research fellow for the IGov project at the University of Exeter, investigating energy governance. She features on the Woman's Hour Our Planet Power List which highlights 30 women making an impact by helping to protect our planet. Her book, '*Too Hot To Handle? The democratic challenge of climate change*' was published by Bristol University Press in March 2020.

Andy Yuille

Andy Yuille is a Senior Research Associate in the Lancaster Environment Centre. His research focuses on the interfaces between different knowledges, experiences and practices, in particular relating to environmental decision-making. He is interested in how environmental problems are brought into being, how different human and non-human elements of 'the problem' come to be related in specific ways, and how different relations that might prove less problematic can be brought about. He combines 15 years' experience of influencing public decision-making through working with NGOs, community groups and public-private partnerships, with an academic approach informed by Science and Technology Studies and the idea of public sociology.

sustainability

MDPI

Editorial

Introduction to the Special Issue "Bringing Governance Back Home: Lessons for Local Government Regarding Rapid Climate Action"

David Tyfield * and Andy Yuille

Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YW, UK; a.yuille1@lancaster.ac.uk
* Correspondence: d.tyfield@lancaster.ac.uk

Citation: Tyfield, D.; Yuille, A. Introduction to the Special Issue "Bringing Governance Back Home: Lessons for Local Government Regarding Rapid Climate Action". *Sustainability* **2022**, *14*, 5310. https://doi.org/10.3390/su14095310

Received: 24 April 2022
Accepted: 26 April 2022
Published: 28 April 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

There is a growing recognition both that rapid action on climate change is urgently necessary, and that many of the responsibilities for this action (e.g., around transport, land use planning and economic development) rest at a local level. Attesting to this are the growing number of local authorities internationally that have declared climate emergencies, especially since 2019. Responding to this emergency will require significant changes to the assumptions, expectations, priorities and procedures of locally elected representatives and government officials.

While questions about technical solutions and policy design for rapid climate action have been well studied, little attention has hitherto been paid to the crucial question of how such outcomes might be implemented, by whom, and how action is enabled or constrained by the institutional and other sociotechnical relations in which these actors are embedded. This Special Issue examines some of the ways in which the individuals and institutions of local authorities and their partners have begun to engage with the new challenges of local climate governance.

The climate emergency can be viewed as a failure of governance relations between state and diverse non-state actors. In this context, two apparently contradictory narratives arise from discussions about appropriate governance responses. As over-simplifications, these tend to be broadly framed as calling for more or less democracy.

The first calls for the building of new polities capable of governing themselves collaboratively, which include politicians, citizens and private, public, and third sectors. This approach blurs conventional dualisms between the governing and the governed, expert and lay, and ordinary citizens and decision-makers. It challenges orthodox norms of governance, building on decades of research and advocacy around the democratization of science and participation in technoscientific decision-making [1–3].

The second calls for improving, rather than diluting, the professionalised institutional divisions of labour within governance, and particularly emphasises capacities for strong governmental leadership informed by rigorous scientific analysis [4]. This approach, in turn, challenges more critical, heterodox approaches to governance, which have been argued to provide a utopian and/or overly holistic account of participatory governance, neglecting a multitude of embedded relations of power that are not easily disentangled, and fetishizing the capacity of 'the local' as the scale at which competing priorities can best be resolved [5–7].

However, in this introduction, informed by the papers that follow, we argue that these approaches are only apparently contradictory. Specifically, these two positions seem opposed and incompatible when viewed from a conventional, instrumental perspective which seeks to discover the 'right' solution to a problem which exists independently 'out there' in the world. By contrast, we suggest that these approaches can rather be complementary (albeit always messy, imperfect and incomplete) when viewed from a pragmatic

position of endemic uncertainty and continual learning. From this perspective the latter, more hierarchical approach can develop to support and shape the former, providing key elements of unified political will, action or delivery, and competence, distributed across an effective division of responsibilities. Conversely, the former, more participatory approach can provide the distributed learning and particular subjectivities necessary to underpin and commit to the latter.

This perspective, which values ongoing pragmatic learning and the development of practical wisdom from personal experience in a state of perpetual uncertainty, we term 'phronesis' [8]. From this perspective the process of transition to a 'net zero' carbon future is one in which not only the practices necessary to achieve those ends, but also the precise nature of the ends themselves, are continually unfolding, and with this parallel dynamic self-consciously cultivated. The central questions then come to revolve around situated institutional and individual capacities to learn and continually adapt to doing governance better at this scale and across scales, as necessary.

The rest of this introduction is split into three sections. First, we review some of the themes that arise from a reading of the papers collectively. Next, following the lead of these common themes, we develop the idea of applying a phronetic approach as the key missing piece in the puzzle of local climate governance. Finally, we introduce the papers themselves, briefly summarising each one and the particular contributions they make to the Special Issue. Drawing on the actual experience of the individuals and institutions at the centre of local governance responses to the climate emergency, these papers collectively contribute to, exemplify and call for the learning that will be necessary to adapt to this urgent and pervasive challenge.

2. Emerging Themes

The papers in this Special Issue reflect a range of issues and geographies. There are two papers from the global South (specifically from middle-income, settler post-colonial and climatically temperate sites, viz. Cape Town in South Africa and Chile) and five from the global North (or more specifically, four from the UK and one from north west Europe). Two deal with transport, one with housing, one with sanitation, and three with cross-sectoral local governance of climate issues. Their objects range in scale from the hyper-local to the megacity and the cross-boundary.

Nevertheless, several core themes strongly emerge from the collection. We hope that, in reading them, you will agree with us that together these articles do an exemplary job of illuminating these themes with practical insight and purpose. They will be of use not just to researchers, but to people working in and with local authorities on climate governance—again, at least across the democratic global North and 'near-North'. By highlighting some of the features of their everyday experience and exploring their causes and connections, we hope that this collection might suggest some practical ways forward to diverse readers. However, the Special Issue also draws attention to differences as well as similarities across places, and the need for sensitivity to situational specificity.

First, the most prominent shared theme is the need for institutional and, indeed, constitutional change: the present emerges clearly as a moment, akin to the early 19th century in Europe, in which the political imperative is one of reform and re-establishment of state settlements, particularly regarding relations between national and sub-national/local government. The papers consistently describe a lack of integration or coordination between formal and informal governance actors on a vertical scale, i.e., between national, regional and local tiers of government and their partners, and a concomitant lack of strong national leadership. They also describe a lack of horizontal coordination and integration, i.e., a fragmentation of interests, action and understanding between governance organisations operating on or within the same spatial scale, and with other stakeholders and publics. They even identify such fragmentation occurring within organisations, particularly local authorities.

The picture that emerges from these papers is thus of an inconsistent patchwork of approaches, developed piecemeal in different territories and scales, both top-down and bottom-up, and characterized by a proliferating and fissiparous complexity. What it is not, therefore, is a coherent framework. The lack of scalar and sectoral coordination and transparency both inhibits effective action, and enables inaction and blame-shifting. This feeds the further proliferation of fragmenting and overwhelming complexity, as opposed to integrated and unified direction. The local is often lionized both in the academic literature on governance, and in policy and practice, and as these papers demonstrate, some local and bottom-up action is possible. However, this is highly variable across scales and territories, and is fragile and open to disruption. It is clear that 'the local' is per se no more pragmatic, or less political and fractious, than any other scale.

Moreover, even to the extent national government is coming around to accept and even proselytise more local powers, this tends to take a form that militates against its effective realisation. Instead, national government tends to continue to hold tight to the reins of power, while perhaps doling out limited powers and ring-fenced pots of money through specific and competitive policy initiatives that come with significant strings attached [9,10]. Certainly, this is the current situation in the UK, as recent announcements regarding the actual form of the flagship manifesto policy of 'levelling up' the regions (specifically the north of England vs. London), and associated (limited) devolution, has illustrated [11].

The papers as a collection thus make a significant contribution to the argument that constitutional change is required to establish consistent national approaches to, and coherent sub-national and cross-sectoral distributions of, powers, responsibilities, accountability and funding for the unprecedented governance challenge of climate action. Devolution and a focus on the local are often touted as solutions to governance problems. However, another theme emerging from this collection of papers is that simple devolution may simply lock in existing inequalities and feedback loops. This is illustrated at wide range of scales, from the international to the hyper-local. Or, to put this the other way around, the nation-state and national scale also remains crucial, if in need of significant reshaping and reorientation.

The papers which consider cases in the global South are concerned with the urgency of increasing resilience and adaptation to the consequences of climate change, reflecting their status as communities which are most vulnerable to those impacts. Meanwhile those examining cases in Europe, in communities that are less vulnerable, are able to focus on the challenges of decarbonisation in various ways. This includes, illustrated in parish councils in one county in England, a wide range of responses—or absence of response—to the climate emergency. Several papers illustrate the potential for generating change and momentum at a local level, but also the fragility of this in the face of structural challenges; structural challenges to which national (and thence inter-national) government alone can effectively respond. Interventions need to recognise the existing capacities of places for constructive or destructive feedback loops, and the need for cohesion and solidarity at a higher level. A strategic and coherent trans- or multi-scalar governance approach is needed at international, national and sub-national scales to intervene in already-existing inequalities and to prevent positive feedback loops exacerbating cycles of inequality.

However, while the papers illustrate the vast gap between current situations and the kind of practices and institutional structures that might be needed for effective governance in a climate emergency, they also offer glimpses of hope in already ongoing practices. The potential for doing things better is clearly visible in the seeds of practical action that are already being sown, with insights into how things have been, are being, and could be done, at the level of local governance specifically.

Locally led, independent climate action is being driven variously from the (local) top down and the bottom up in different locations. However, these steps in the right direction are tentative and fragile, lack coordination or strategic connection, and are subject to disruption in the absence of a new constitutional settlement vis-à-vis the nation-state that would provide a more nurturing environment for them. However, although the papers make a collective case for a more coherent approach to sub-national climate action, they

also recognise the need for flexibility, for local specificity and response-ability to specific local situatedness. What emerges therefore is not a clear picture of what coherence looks like, but rather the need for transparency, clarity, and cross-sector, cross-scalar co-operation in its very development. What also emerges, at the very least, is a call for urgent discussion, public and scholarly, and experiment on such constitutional issues as a key pillar of climate action, not a rabbit-hole distraction from it.

Yet, secondly, there is also a pragmatic emphasis across the papers on starting from where we find ourselves now. Certainly, the points just made regarding constitutional and institutional reorganization must not be read as the forlorn demand that 'we shouldn't start from here'. Indeed, amidst all the complexity that characterises local government/politics today, one may be moved to ask how such constitutional resettlement could even be attempted without simply making matters even more complex and, hence, intractable. A pragmatic approach demands recognizing that institutional change does not generally happen quickly, not least because of the intrinsic 'self-cementing' dynamics of (governmental) power relations. Yet, the argument remains unequivocal across the papers that existing institutional structures are not well-suited to tackling the climate emergency, and that this suboptimal present embeds a host of complicated and often unhelpful power relations.

If this is not to be simply a cause of despair, it follows that there is no option but to work with the situations and power relations which actually exist, and the webs of interests, priorities, conventions and norms that that implies. Many of the papers also offer, explicitly or implicitly, an understanding that the futures we move towards will also thus be suboptimal, at least partly because we do not know in advance what an optimal future might look like. However, this should not prevent us from building on the present seeds of hope towards an end (e.g., a net-zero-carbon future) that is at once both desirable and open or indeterminate. It is possible, even desirable, to acknowledge uncertainty about a future end state and still take steps towards it, with a view to learning more about both the destination and how to reach it on the way. Moreover, the goal or challenge thus emerges clearly as reforming the institutions and settlements of local government *in parallel* with continued action by local government on climate, rather than the seemingly rational approach of first getting the former 'right'.

Thirdly, then, many of the papers also identify, explicitly or implicitly, specific factors which enable and constrain rapid climate action. This, in a way, also provides reasons for hope, as it allows for practical learning from existing situations in order to adapt and adjust as institutions move forward. While not providing a route map to a net-zero-carbon future, let alone a (utopian?) blueprint of that destination, they may provide something akin to a compass direction. They offer a clear-eyed assessment of the challenges, and a means of understanding and thus navigating through them from within. There is also a recognition that these understandings are situated—the factors that enable and constrain action are not universal and will depend on local specificity. Here, the diversity of cases also helps, providing a means for actors to sensitise themselves to unfamiliar situations and perspectives, and hence to the potential for action, and with much more work to be done in this regard in future research.

Good (and bad) practice can be (and are already being) identified and learned from, along with the causes and influences on those practices and their effects. Again, practices are specific responses to local situations, so lessons from them should be contextualised as inputs that sensitise rather than universal applications: insights generated in one site can suggest possibilities for the attention, analysis and intervention of researchers and practitioners elsewhere, rather than indicating the desirability of the wholesale transfer of practices [12]. The value of learning, and continuing to learn, —and hence, in turn, learning *how to learn*, or what Bateson referred to as 'learning 2′ [13]—from these examples cannot be over-emphasised, and both individually and collectively/institutionally. A crucial lesson that we have drawn from this process is the need to understand institutional dynamics better in relation to climate governance, and the importance of investing in institutional capacities to engage in processes of ongoing learning.

3. Phronesis—The Vital Missing Piece

There is, therefore, considerable insight and agreement across the papers that follow. Yet, what arguably remains missing is a terminology and/or framework that promises to be able to synthesize the wide-ranging points made above into a coherent and readily comprehensible whole. Such coherence, or at least the palpable sense of its immanent and imminent possibility, seems particularly important in the context of the current challenge being not simply *climate* action (i.e., in all its complexity, existential stakes and urgency) but also climate *action*.

How, in other words, are all these disparate insights to be held together and easily accessed by those actually tasked with the massive challenge of doing something about expedited and 'just' transition [14]; those who must attend to the concrete detail of actual climate challenges and so cannot spare hours and/or 'brain space' for the abstract lessons above, in all *their* complexity? How can all these points be condensed—but not 'reduced'—to a single, memorable and yet productive, enabling idea? Our argument here is that this can indeed be done, and under the terminology of 'phronesis'.

As detailed in Yuille et al. in this volume [Contribution 1] (and see also [15]), 'phronesis' connotes the situated practical wisdom needed to (learn how to) govern complex dynamics systems well, and hence situated *within* such predicaments. It takes its name and inspiration from Aristotle's primary epistemic virtue. This is the practice and capacity for judgement presupposed by the skilful exercise of the two more familiar forms of knowledge that have dominated the modern age and brought us to our current predicament of global complex systems challenges, namely: episteme, or abstract 'what/why' knowledge of 'natural law'; and techne, or concrete 'know how'.

Yet, the resurrection of the term has also involved its fundamental redefinition [8,16] to incorporate in that 'situated practical wisdom' a deliberate attentiveness to issues of differential power relations in which all human agents are necessarily situated at any given place and time. Indeed, drawing specifically on the insights in the later work of Michel Foucault [17,18] regarding the inseparability of human power relations and (assertions/deployment of) knowledge, phronesis is thereby expanded and redefined. It becomes 'situated practical wisdom' that is both, and simultaneously, always strategic—vis-à-vis attention to those irreducible power relations—*and* ethical—regarding the personal sensitivity to questions of truth and value implicit in the designation of beliefs as 'knowledge'.

In our own contribution to this Special Issue, written without the benefit of having already read and reflected on all the other articles, we foreground and investigate the importance of phronesis for local government climate action in one particular sense. Specifically, we foreground the importance of institutional and personal capacity to learn about *how* climate action might, and/or does, actually best work in the situated institutional and cultural-political-economic setting in question. In other words, we focus on the strategic dimension of phronesis, and its phronetic learning process.

This led us to identify four key roles for effective local government climate action (namely 'crusaders', 'pragmatists', 'entrepreneurs' and 'weavers'). (For a similar argument from economic geography/regional development literature encountered since writing that article, see [19]). All four of these roles are crucial, but with one in particular often undervalued and neglected, namely 'weavers'—see Tables 1 and 2, reproduced from Contribution 1, this volume).

What is brought to light in synthetic reflection on the whole collection, though, is the importance also—if not pre-eminently—of the other, parallel element of ethical dimensions of situated practical wisdom. In short, phronesis emerges across all the papers as the self-conscious practice and orientation to cultivation of ever-greater skilfulness in *both* strategic and ethical regards, and hence, in turn, to learning about such learning.

As such, there is much more to say about phronesis, what it is and how to do it, and why it is so important—indeed primary, the key missing piece—regarding local government climate action. We do not propose to exhaust this further exploration here, but only to open up this wider agenda for further research.

Table 1. Ways of engaging with the climate agenda.

Persona	Defining Characteristic
Crusader	Seeks to establish climate action as an urgent priority
Entrepreneur	Seeks to integrate climate with existing programmes and priorities
Pragmatist	Seeks to deliver climate action within existing policy and procedural framework
Weaver	Seeks to build widespread support for climate action

Table 2. Plotting the typology of 'personas' vis-a-vis primary concern against primary focus.

		Primary Concern	
		Goal/Direction	***Implementation***
Primary focus	*What*	Crusader	Pragmatist
	How	Entrepreneur	Weaver

One way into this broader perspective on phronesis and its importance is via consideration of current climate politics, especially in the global North. Some two years on from the initial efflorescence of 'climate strikes' and subsequent declarations of 'climate emergency' that prompted this Special Issue—and with the profound changes initiated by the pandemic as well—it is now apparently the case that political consensus regarding the need for (some) climate action is effectively established. Yet, debate has thus simply shifted terrain, most obviously through and after COP26 in Glasgow, towards a new and emergent polarization, broadly between 'crusaders' and 'pragmatists' regarding the pace and profundity of climate action, in bitter and deepening stand-off. These dynamics are further exacerbated by the looming danger that climate politics is pulled into the ongoing 'culture war' of identity politics unfolding across the global North [20]. Moreover, this emergent political fissure has become palpable in local politics, e.g., regarding 'low traffic neighbourhood' plans, thereby furnishing a salutary puncturing of the bubble of fetishized local as supposedly always more productive and harmonious than national politics [21].

Seeking thus to go beyond this increasingly hostile and obstructive context, one key element of phronesis that emerges into view is the imperative of recognizing the validity of concerns about (or, conversely, valuing) *both* continuity (pragmatists) and discontinuity (crusaders). A phronetic approach would, rather, move to put both orientations into productive relation.

Viewing Tables 1 and 2 in this light, however, readily suggests a way forward. This relation is formed by the bridging activity of the two other roles, entrepreneurs and weavers. As such, the importance of these two roles is illuminated further. So too is the importance of a reframed approach to addressing the key question of: "how should the operations and institutions of local government be (re-)arranged so that they are more effective in realizing their stated goals of deep, expedited, locally-relevant climate action?"

However, in identifying these bridging roles, and the fact that there are two of them, we also find here a further dimension that needs to be taken up explicitly and then with balance explicitly cultivated in that regard as well. This second dimension concerns a spectrum between the opportunistic, self-starting innovation of the entrepreneur and the integrating work of the weaver. It is thus a spectrum of (individual) action and its priorities. By contrast, the continuity/discontinuity spectrum is also clearly thus one of institutional form and practices.

Closer specification of phronesis therefore precisely illuminates two key dimensions and with the challenge being to cultivate skilful balance in *both*, since both ends of their respective spectra are valid and valuable concerns and approaches (Figure 1, below). Moreover, the present situation is thus elucidated, in that what is missing primarily today is, first, the latter dimension (to bridge the polarized politics of pragmatist/crusader); and then the (re)balancing from opportunistic innovation/entrepreneur to integrating/weaver.

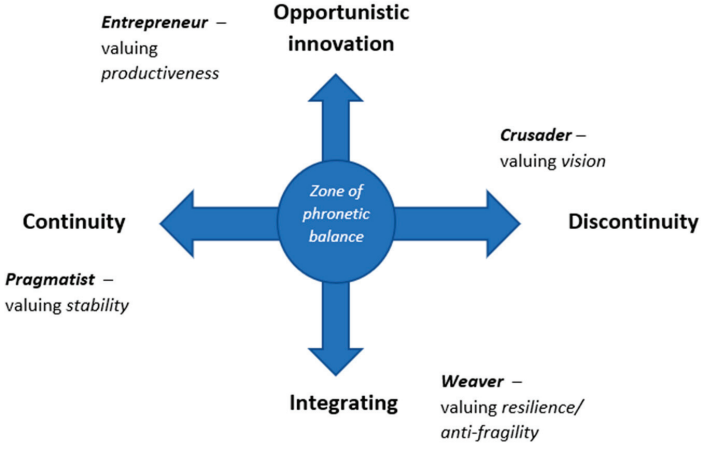


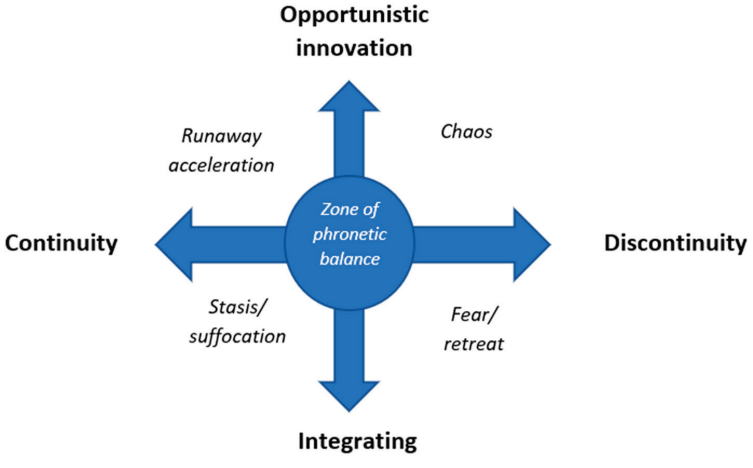
Figure 1. Key concerns and key roles for local government climate action.

As such, it is emphatically not that weavers are per se primary, as necessary *and sufficient* condition for effective local climate action; a sort of fundamental capacity or institutional silver bullet. Rather, they are the role amongst the set of all four that is at present systematically neglected and undervalued, and most in need of concerted support, including in terms of investment in institutional capacity for such 'weaving' work (both within local government institutions themselves, and externally, in consultation and communication with local stakeholders).

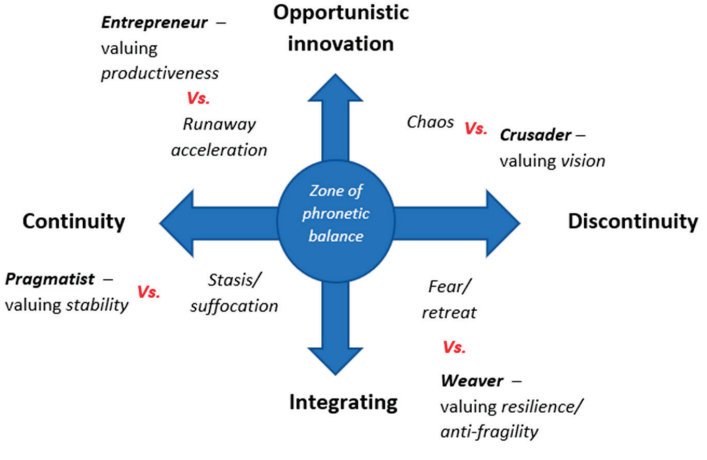
Indeed, if a particular dysfunctional state of affairs can be seen to manifest the imbalanced dominance of each of the four resulting quadrants (Figure 2a) then each role, if skilfully (i.e., phronetically) performed, serves to counteract and harness one of these as its respective 'near enemy' (Figure 2b). For instance, a governance context in which opportunistic innovation and continuity are combined without counter-balance may well lead to runaway acceleration of technoeconomic change [22], locking in a specific direction (hence 'continuity') of rapid economic growth and inequalities (hence 'opportunistic innovation'). Yet, there is also here the opportunity for the (local government) 'entrepreneur' to contain and redirect these dynamics, especially when in combination with appropriate mix of the other three roles.

However, this framework also invites yet deeper understanding, up to a more profound shift in perspective. Specifically, the first step, of adding the dimension of individual action and ethics, transforms one's relation to the question of 'what needs to happen for local government to be up to the challenge of climate action?' By default, we will tend to interpret this as a purely institutional question, 'out there', of how to 'get local government right' so that it can then go and 'do climate action right'. To be sure, this approach, by shifting to 'how' questions, is an advance on the predominant approach of simply neglecting the capacities of current institutions of local government and presuming they are adequate, leaping straight to the question of '*what* must be done?' (see Contribution 1, this volume). However, this approach is still, nonetheless, a manifestation of precisely the problem; and especially insofar as it simply accepts the already inimical context of austerity, inadequate capacity, etc., and overlays it with perspectives and expectations that make 'progress' all but impossible.

Instead, by *first* reorienting to see the bridging roles as crucial, one also thereby admits the associated concern of the deliberate cultivation of a *collective ethic of personal responsibility, ethical reflection and learning* as sine qua non for any progressive institutional reform [23]. Yet, if the vertical dimension is understood in this way, the horizontal dimension is likewise reimagined. Specifically, the 'obvious' question above, concerning local government reform, gets recast.



(**a**)



(**b**)

Figure 2. (**a**) Potential dysfunctional states associated with imbalanced priorities; (**b**) Counterbalancing influences of 'near enemy' roles.

No longer is it a purely institutional question. Instead, it becomes one of situated exploration of a *personalized* strategic practice of ever-greater conviviality, governmental competence and collective learning thereon. The individual stakeholder in local government and their ethical action thus becomes the essential window and/or vehicle for all effective governmental climate action, including the progressive improvement of the very institutions of local government.

In this way, phronesis is shown, indeed, to involve the concerted cultivation of two orthogonal, but now mutually reinforcing, issues or approaches, as against a prevailing common-sense that focuses only on one, and then in a very different form. Effective and phronetic local government climate action demands both concerted personal reflection on ends and questions of value, in and through activity together with, and in relation to,

others; *and* concerted collective reflection on the strategic openings of oneself and others given current systems of power relations and situatedness within them. Hence, intrinsically consisting of both an ethical–individual and strategic/political–collective moment, and/or a power–*knowledge* and *power*–knowledge moment, respectively.

Such practice(s) of phronesis (i.e., of such learning, and learning about learning . . .), personal and collective, then themselves cultivate the activity, direction and momentum of the progressive institutional change and activity desired.I Indeed, they just *are* the practising of the transformed outcome (or 'transition' [24]) to which change is needed. For this activity is the cultivation of phronetic institutions and form of government [25] that is resilient or anti-fragile [26] precisely in being optimally capable of collective (and inseparably, personal) learning *because it is specifically and primarily oriented to that phronetic goal*.

What has thus emerged, therefore, is a counter-intuitive but arresting—and, crucially, simple hence memorable—conclusion: that the cultivation of phronesis is thus the *primary goal* of local government that is seeking to respond more adequately to climate emergency, even as it may seem initially as just a useful approach or means to that end. As such, reorienting to this perspective also then provides the key missing piece or new synthetic worldview [27], that affords the integrating of disparate insights. Indeed, with the new goal of vision thus clarified, at least as initial gestalt (or even 'flip' *Cf* [28]), these further insights can now begin to form a positive feedback spiral of activity and learning on an ongoing basis and amongst an ever-growing (and potentially fast-spreading) group of thoughtful practitioners. With the paradigm shift, in other words, such insights as occur to the disparate concrete individuals tasked with local climate action can begin to accumulate and so gather momentum as more than the sum of their parts, rather than less; avoiding a confusing mess that is simply adding to the overwhelming complexity, as is the constant risk at present.

Indeed, here we can even begin to trace the first steps towards the urgently needed reframing of a more concrete ideal enabling of such (re)constructive positive feedback loops of activity: a long-needed and -sought-for new 'ideal' of urban life and infrastructure. This has been missing since the disintegration of the 'integrated ideal' of the nineteenth to mid-twentieth century global North into the global 'splintering urbanism' of the late twentieth / early twenty-first century [29], and now culminating in a 'new urban crisis' [30]. The phronetic vision of today, however, is not a new 'integrated ideal' but rather a new 'integrat*ing imaginary* or *vision*', with the new productive process of *integrating* (and infrastructur*ing* to boot [31]) coming first, *then* informing the new 'ideal' or, rather, imaginary [32,33] or vision [27].

Here again, therefore, the work of the weaver is today the necessary first step. For this reframes the equally necessary (but much more commonplace) activity of the crusader as a *pragmatic* idealism, and hence potentially in productive relation with the pragmatist. Conversely, absent the weaver's influence, the crusader will tend towards strident, ideological idealism, which just polarizes and repels the pragmatist, such that they in turn may progressively become ever more cynical and intransigent in their 'realism', in positive feedback loops of mutual stand-off.

In short, from our starting question of 'how can we do local government better to tackle climate emergency and unleash its potential in this regard?', which suggests specific forms of institutional action in response, the papers here, and this reflection on them, lead to a surprising but thereby productive conclusion. The way forward on this very question actually lies elsewhere: in the decision to put phronesis and its cultivation centre-stage. This applies to both the personal action of those associated with the running of local government and politics (hence local government staff/civil servants and representatives in the first instance, but also, ultimately, all other local stakeholders too) and in the explicit operations and vision statements of the institutions of local government itself. Additionally, this requires the deliberate cultivation of balance (and rebalancing, as reintegrating) in two dimensions and *across* those dimensions, namely collective strategizing and individual ethics. It is the latter, though, that has been most neglected and hence demands most

attention today. Hence, perhaps most counter-intuitively, we have here emphasised the centrality for local government climate action of work on the self and self-responsibility and the associated shift in perspective or mind [34], which can likewise only happen in and by individuals for themselves, albeit progressively over time and in active practice with others.

4. The Articles—Concrete Insights from Diverse Case Studies

Phronesis thus, we argue, presents a keyword—i.e., a compelling and fertile singular terminology and focus—for future research and practice on local government climate action. However, what do the papers of this collection have to say in this regard? We close this Introduction by turning to them, in the hope that we can situate all their diverse and insightful contributions together into a loose and productive synthesis while not aiming to claim too tight or definitive a unity of their diverse positions. Indeed, lest it need be said, we strongly encourage readers to read the articles themselves to hear the contributors in their own voice and in all their insightful detail.

It feels appropriate to start with the greater, and daunting, challenges faced by local government in the Global South. Substantial populations are vulnerable to extreme weather and disasters linked to climate change due to a lack of resilient critical infrastructure. Using data from 345 Chilean local authorities, Valdivieso, Neudorfer and Andersson [Contribution 2] examine how internal and external institutional dynamics and arrangements shape decision-making around investment in resilient critical infrastructure, a field usually examined from a technical-economic perspective.

They show that institutional dynamics moderate between capacities to act (in terms of political leadership and availability of resources) and actual outcomes (in terms of decisions to invest in new critical infrastructure). In particular, more robust internal organisational arrangements such as internal regulations, planning, coordination, and integration were associated with higher levels of investment. They observe that existing norms, conventions, routines and expectations can lead to resistance to change, and may be internally contradictory, recommending bottom-up improvements to municipal organisational robustness in terms of operational rules, communication and coordination, integration, transparency, accountability, and political support. They suggest that this can be a more significant factor in driving effective climate adaptation action than money transfers from higher-level government or other external interventions.

The key point of their article, therefore, is that organisational competence is central to successful climate action. While attending to, and investing in, institutional competences and capacities may sometimes appear like a distraction from the urgency of climate action (especially to 'crusading' individuals with a clear vision for a future which is markedly different to the past), Valdivieso et al. clearly show that it is central to its effective delivery. Resonating thus with the argument above, 'municipal robustness' is, arguably, a further specification of institutional-level phronesis. Their articulation of municipal robustness foregrounds the need to strike a balance between forces pulling in different directions, e.g., flexibility vs. planning, integration vs. division of labour. This balancing of forces does not come from a universally applicable algorithm, but from the practical wisdom and skilled judgements of individuals operating within institutions that both recognise the need to strike these balances, and provide them with structures within which they can make those judgements. Again, without claiming Valdivieso et al.'s total agreement to the centrality of phronesis as presented, resonance with the arguments above regarding the importance of 'phronetic balance' is striking in this regard.

Peirson and Ziervogel's article [Contribution 3] also deals with the provision of infrastructure in vulnerable communities. They focus on the ways in which informal settlements in the Global South, with basic and/or inadequate service infrastructures and informal relations with utilities companies and municipal states, adapt to the impacts of climate change, through the lens of a sanitation upgrade project in a settlement in Cape Town, South Africa. Inadequate infrastructure increases vulnerabilities to the effects of climate

change, and climate change in turn exacerbates those structural vulnerabilities in positive feedback loops symptomatic of the kinds of complex system challenges and dynamics that demand a phronetic approach in response. Recognising that technical solutions often increase inequalities as they do not reach the most vulnerable communities, they examine the complex socio-institutional context in which this project developed, exploring the interactions between community groups, an NGO, and the local authority. In the case they detail, the upgrading project faltered, after a promising start, due to conflicting priorities, leading to a breakdown in relations and disagreement between different city departments and the community on how to proceed. This fuelled a longstanding resentment and mistrust of the local authority amongst the community, despite recognition of some officials engaging more openly. Here, in other words, we see collective and institutional impacts quickly morphing into personal and inter-personal issues (e.g., feelings of mistrust, disappointment, betrayal . . .) that then risk becoming particularly intractable, while also thereby simply exacerbating the existing challenges at the former, institutional level.

The article identifies more effective multi-level governance and inclusive horizontal coordination as particularly crucial for climate action related to informal settlements, and highlight the key enabling and constraining factors to these in this case. Peirson and Ziervogel emphasise the fragility of bottom-up, non-state action—given its still-overwhelming dependence on (inter-)personal factors, of enthusiasm, resources, connections etc.—and the need for sensitive, co-operative and transparent state support for and engagement with such action. This specifically includes the need to engage with socio-institutional factors, different socio-political realities and lived experiences, rather than assuming that multiple and diverse actors can be subsumed into a centralised, technocratic approach.

Such considerations again point to the value of a phronetic approach, of a process of ongoing learning from personal experience by concrete and diverse individuals in necessarily suboptimal situations. It particularly emphasises the importance of the often-overlooked integrating role between the forces of continuity and discontinuity, which values and can produce greater resilience in relations both within and between governance actors. It also highlights that this role is itself an ongoing process and cannot be considered as a one-off stage that can be completed and then moved beyond. In the Global South in particular, NGOs may be particularly well-placed to play these bridging roles, especially so long as they retain an explicit 'weaver' (and/or 'entrepreneur') approach and self-definition and do not veer too much into 'crusader' mode.

Turning to the papers from northwest Europe, over 70% of local authorities in the UK have declared a climate emergency, signalling an intention to align their policies and practices with the urgent need to tackle this emergency. However, there remains a significant gap between these high-level intentions and the actions necessary to achieve them. Yuille, Tyfield and Willis [Contribution 1] examine this gap in three UK cities—Belfast, Edinburgh and Leeds—focusing on the actual experience and understandings of local decision-makers. They identify a series of enabling and constraining factors that explain this gap, including: the shifting political priority of the climate agenda; limited understanding of how climate goals can be achieved; the interaction of national and local scales of governance; organisational culture within local authorities and their partners; the different ways in which the issue is framed; conflicts between high-level support and contentious detailed implementation; the ways in which climate action is understood as locally specific; and the risks and opportunities presented by the COVID-19 pandemic.

These factors represent a relatively uncontroversial mapping of *what* the challenges, opportunities, and barriers relating to rapid climate action are. Yuille et al. then move on to address *how* local politicians and officials engage with these factors as part of their everyday working lives. They identify distinctive patterns in working practices which different individuals may enact at different times, categorising them (as noted above) as 'crusaders', 'entrepreneurs', pragmatists' and 'weavers'. They emphasise the importance of ongoing learning from lived experience, at individual and institutional level, thereby continually shaping and re-shaping climate governance by focusing not just on *what* needs

to be done, but on *how* local decision-makers can navigate their way through a landscape of conflicting priorities and pressures. The clear connection of these arguments to that of this Introduction has already been drawn out above.

Russell and Christie observe that the increasing interest in climate governance has tended to focus on global and national (and to a lesser extent city) scales, but that local governance is often acknowledged as a source of pioneering bottom-up action [Contribution 4]. Their article focuses on mapping and understanding micro-level climate governance in the UK, exploring the climate actions of the town and parish councils in Waverley Borough in the county of Surrey. They find that, despite a lack of national or sub-national coordination, some forms of climate action are being progressed by the County and Borough councils, as well as by some of the town and parish councils that sit below them. However, they describe these actions as improvisational and compensatory: compensating for higher levels failures and failures of coordination, and improvising due to the lack of coordination. Action is territorially highly variable, disjointed, not always evidently tied to specific local goals, and with little evidence of effectiveness. Even flows of information are horizontally and vertically limited.

In this context, Russell and Christie highlight the importance of 'wilful actors' who initiate activity with little or no support, guidance or leadership from higher levels of governance in driving local climate action. Like the bottom-up actions described in Cape Town, these too are fragile in the absence of improved horizontal and vertical coordination, revealing interesting analogies even across very different contexts: informal settlements in Cape Town and comparatively affluent communities in London's 'leafy' commuter-belt. That similar conclusions regarding challenges and approach straddle such differences speaks to the effective—and not premature—universality of a phronetic approach.

However, our phronetic framing also suggests another form of fragility for these actions. As wilful actors are by definition pushing visions of discontinuity, enacting a 'crusading' role, they will often find themselves confronting pragmatist actors who value continuity, and in the absence of the bridging roles of opportunistic innovating (the entrepreneur role) or integrating (the weaver role), this confrontation can lead to stalemated paralysis. In any event, this default combination of crusaders and pragmatists alone is likely to lead to the totality of these 'DIY' actions adding up to less than the sum of their parts. Greater coordination, information and knowledge-sharing—more 'weaving' actions—are identified as crucial to re-make institutions that are capable of governance for a climate emergency.

In her article in sister journal *World* that is also associated with this Special Issue, von Hellermann [Contribution 5] likewise discusses the challenges of sustaining bottom-up volunteer-based local climate action as a model of local government and the limitations of the kinds of issues that tend to be addressed given this approach. The article focuses on the case of Eastbourne, a conservative town with a significant retired population on the south coast of England, and the council-citizen collaborative network model of climate governance that has emerged there since a declaration of climate emergency in 2019. She provides an auto-ethnographic account of the ups and downs, pros and cons, of such a distributed approach, dependent largely on citizen activism in collaboration with, but receiving little top-down support from, local government. Focusing on "target working groups . . . bringing together councillors, engaged citizens and providers" focusing on specific issues—initially trees, transport and education—the article explores the diverse constraints on effective and enduring climate governance at local level, considering both institutional and personal factors.

Regarding the former, for instance, again we find here reference to the limited budgets, time and powers of local government (in the UK), now made even harder in the context of the (post-)pandemic exigencies. Yet, it is regarding the latter, and/or its overlap and interaction with the former, that von Hellermann is most illuminating. For instance, we find that different expectations and understandings of the role and capacities of local government and/or citizen volunteers amongst different parties significantly complicates

sustaining such initiatives, no matter the original optimism and energy with which they may be launched. Moreover, these disagreements appear to be most problematic where these expectations are polarized regarding the division of governmental labour between existing institutions and citizen volunteers, e.g., where staff at the former feel the limitations of their powers and so hope the latter will make happen what they cannot, while the latter may resent being asked to do—and for free—tasks that they see as 'evidently' the remit of council professionals. Here too, though, we find a blurred line between the emergence of disagreement on such matters and simple clash of personality, or institutional hurdles/supports and personal competence and approach, with both being crucial 'micro-dynamics' in the functioning, or not, of local government climate action.

The result is that the range of issues stressed by von Hellermann as crucial, and as key arenas of strategic learning, likewise range across the full spectrum, institutional to personal, strategic means to value and ends, political to ethical, highlighted by the explanation of phronesis above; and, crucially, with intimate connections and feedback loops amongst these seemingly polarized and dualistic concerns, hence demanding always holding both in mind. For instance, von Hellermann calls eloquently for a 'both/and' approach of bottom-up action *and* top-down support, and likewise personal change *and* institutional reform.

The importance of the latter is undeniable given that "a large part of the measures required to reduce ... carbon emissions are fundamentally more about infrastructure changes that indeed need to be delivered by the authorities". Similarly, it follows that "[t]he real power and importance of both local governments and schools ultimately lies less in (so exhausting yet so pitiful) local initiatives like ours, but in key instruments of delivery of wider, national initiatives".

Yet the irreducible importance and centrality of the former is also illuminated here: whether in terms of the central driving force of motivated individuals, both within and outside local government, in instigating change; the challenges of their exhaustion (and with that, the initiatives they have led) and hence the crucial issue of their adequate support and remuneration; or the mediation of all these change dynamics through personal interaction amongst specific, complex, multi-dimensional people. Here, therefore, there is an implicit call for just the kind of phronetic bridging support of weavers, i.e., as key forms of *institutional* support focusing on the (*inter*-)*personal* dimensions of effective local government.

As she also argues, it is really only in personal experience as a citizen volunteer that one comes to a clear and living understanding of issues of strategy and power that are so pivotal regarding effective local climate action. This again illustrates the blurring of dualisms, as it is only in personal practical experience and frustration that one really learns about the seemingly external and collective issues of institutional design and organization, and how it applies 'here' and 'now' in this specific context of climate action. Indeed, von Hellermann even takes this a step further in her advocacy of an 'engaged anthropology' and its potential contribution to local climate action more generally, which may be read as a call precisely for the kind of qualitative strategic learning, personal and collective, that we have advocated as 'phronesis'.

Staying in the south of England, but moving to the importance of the city-level decision-making, Drummond presents a framework to assess the state of ten factors that enable (or inhibit) effective climate governance at the city scale [Contribution 6]. He illustrates this approach through its application to the transition of passenger mobility in London, the UK's only global mega-city and one of the most high-profile cities in the world. This framework builds on work by Van der Heijden [35], while adding two further key governance factors, of 'societal pressure' and 'conducive urban form and infrastructure', to expand the analysis specifically for this issue of urban mobility transition. In doing so, Drummond also finds significant evidence for positivity regarding this case study, with "strong capacity for autonomy, stakeholder participation, local leadership and coordination on climate action", resonating with the issues noted as crucial across many of the other

articles. However, two issues remain causes for concern, namely: "multi-level coordination" in terms of a need for greater coordination between local and national levels of government; and intensifying funding issues, especially in the wake of the pandemic.

As such, Drummond focuses on the specifically institutional strengths and weaknesses in this case regarding local climate action. These issues speak strongly to the more substantive conclusions on this issue from a phronetic perspective, highlighting the importance of such considerations as strategically working with the, no doubt sub-optimal, affordances of the urban form as it is, or an approach balanced between effective engagement with stakeholders and competent, autonomous council leadership. Yet, even in this purely institutional register, the importance of personal, inter-personal and intra-personal (i.e., values) learning and action is still clear.

For instance, the paper notes that horizontal coordination between different constituent borough councils and/or Transport for London (TfL) is often functional only on the basis of uninstitutionalized and personal connections between two officers in the respective organizations, smoothing the process. From a purely institutional perspective, and one politically not uncommon amongst citizen-voters in the global North, relying on such fortuitous connections itself sounds like something of an institutional failure, and certainly clear evidence of a falling short regarding the kind of institutions and capacities needed to tackle these issues. Yet, a phronetic perspective would counsel greater perspective and patience in this regard, accepting that institutions will never be 'perfect' and hence encouraging such strategic initiative within local government insofar as it assists a muddling through and pragmatic realization of such important goals as climate action in whatever ways present themselves.

Consider likewise Drummond's observation that many borough councils do not actually exercise powers, de jure or de facto, that they already have and so are constrained, in such cases, primarily by their own (in)actions, not by objective lack of institutional capacities. Here, again the dual personal/institutional perspective of phronesis proves illuminating. For a more self-conscious adoption of this approach by councils and their staff may encourage a more active and exploratory approach regarding not only what they can in fact already do, resonating with an 'entrepreneur' approach, but also then doing so in ways that bring along other stakeholders in what could be effectively a change in power/relations. Moreover, aggregated over the medium-term, such an approach also illuminates the crucial insight of Drummond, and other papers, that there are significant strategic opportunities to build up the kind of political momentum needed ultimately to demand greater clarity and redistribution from national level—i.e., precisely a constitutional resettlement—through exploiting such loopholes and openings. Such an approach, though, is again not only ultimately premised on the agency of specific individuals, but also on the specifically bridging forms of that agency, forging coalitions behind the demanded institutional changes and, with that, even subtly working towards shifting personal common-senses across society about the values that should 'obviously' be served by local government. The latter, thus, spells important routes to shifting the political mood, including in ways that affect national-level government and political discourse.

These twin demands, of local government 'entrepreneurs' and 'weavers'—and, indeed, thence refashioned and newly complementary 'pragmatists' and 'crusaders'—is likewise clear in the case study across seven local authorities in Belgium, France, the Netherlands and the UK presented by Kwon, Mlecnik and Gruis [Contribution 7]. Focusing on the issue of energy efficiency of residential housing, Kwon et al. present findings from an initiative exploring the comparative advantages of different business models for local authorities to set up 'pop-up centres' encouraging local citizens to upgrade their home insulation.

Here, the starting premise of this initiative is acceptance of the current distribution of powers and budgets to local authorities, aiming to work 'from here'. Across all the localities studied, responsibilities for deep, expedited climate action weigh heavily on local government while funding and policy levers are frequently lacking. In resonance with the broader neoliberal policy orthodoxy of reducing state subsidies and encouraging fiscal

self-sufficiency through enterprise, the experimental approach explored here thus aims to establish service models that are financially self-sustaining while still driving forward on local government agendas. It would be possible, therefore, to read this initiative as itself phronetic, at least in terms of a pragmatic approach working with current circumstances and accepting sub-optimal institutional arrangements as an enduring condition, not simply one that could be quickly rectified were sufficient fiscal largesse and backing from central government forthcoming.

Yet, this would be a partial interpretation of phronesis, as is illustrated by the challenges that Kwon et al. show were faced by this initiative. Most obviously, the issue of horizontal coordination (i.e., between different departments at local authorities) and stakeholder collaboration, including even active uptake of the pop-up consultancy services by citizens, are again mentioned as significant challenges and the more so the more the business model was purely in a standard private enterprise mould focused on maximized 'returns'. In particular, while the policy entrepreneurialism in question proved reasonably effective and successful in some cases, the emphasis on this mode alone, to the exclusion of crusaders and especially weavers, left these initiatives fragile and poorly integrated with their broader normative and/or institutional context. The result is initiatives in which staff may have little longer-term strategic direction or face continual clashes of expectation and goals with others with whom they must collaborate. In short, while an initial and superficial strategic imagination is certainly a start, the hurdles thereby faced lead to a deeper engagement with phronesis and its broader set of concerns.

Finally, returning to the UK, Marsden and Anable pick up the specific issue of coordination between local and national climate policy, offering a UK-wide analysis on policy coherence in decarbonization of transport [Contribution 8]. Noting that current progress on this key high-emission sector is far too slow at present to meet even existing decarbonization targets, and the crucial role of local government in that agenda, the paper argues for the need for setting budgets and decarbonisation policies at different spatial scales, and for coherence across them, mindful of interactions across scales and territories. While the need for such coherence makes intuitive sense regardless of the issue, Marsden and Anable also emphasize its particular importance for transport emissions. Transport inevitably crosses spatial scales yet the existing policy framework in the UK places different levers at different scales. For instance, behaviour change initiatives will often be led locally (e.g., low traffic neighbourhoods, active transport schemes, congestion charging zones etc.) but are conducted within the national framework of subsidy, fuel taxes and regulation, which define the relative costs of different modes of transport.

The article presents informative analytical distinctions between different forms of local/national coherence in climate policy, specifically focusing on three key elements:

- '(carbon) budget coherence' (viz. Are carbon budgets aligned across authorities and scales to add up to national targets? Or indeed set at all, as opposed to inconsistent net-zero target end dates that do not account for cumulative emissions?);
- 'accounting coherence' (viz. What gets counted where and at which scale (city vs. county etc.), given that journeys often start and end in different local authorities); and
- 'policy coherence' (viz. How are budgets and responsibilities aligned with the capacity and powers to act?)

Assessed against these three considerations, Marsden and Anable show that the current situation in the UK (an acknowledge leader in the field, and hence, no doubt, also elsewhere) is a messy patchwork, developed piecemeal in different territories and scales, and both top-down and bottom-up, rather than a coherent framework. The resulting lack of scalar and sectoral coordination or allocation of carbon budgets then obstructs effective action, while also enabling inaction. Indeed, absent such coherence and clarity, there remain considerable obstacles to achieving the transparency in policy goals and means needed to win public trust and to avoid inaction or blame-shifting between governments at different scales.

Crucially, though, the discussion also admits that there are no optimal solutions available, in terms of any wholesale institutional rearrangement, and especially set against the intense time pressure of climate emergency. Instead, the given complexity of policy competencies means that budgets, accounting and policy levers will necessarily be spread across scales of governance and thus need a concerted and medium-term effort to be integrated and joined up. Yet, they argue, any greater coherence in framework, for all the ensuing complexities of achieving this, would be better than the current inconsistencies & inadequacies; while translating national sectoral targets to subnational scales will likely be crucial to bring home to decision-makers the need for urgent and significant action.

Taken together, then, these two key points of the need for coherence and acceptance of the sub-optimal given arrangements, seem to be pulling in opposite directions. Yet, from a phronesis perspective, this is simply to admit the challenging but inescapable predicament of working at achievement over the medium-term of balance amongst equally important and, in fact, complementary-yet-apparently-contradictory imperatives. The alternative is precisely the polarization of positioning between a purist demand for institutional rectification first, effectively delaying climate action indefinitely, or a doomed pragmatism aiming an urgent 'getting on with whatever can be done now', but neglecting the profound limitations in that regard given current institutional arrangements. In short, again we find here the urgent imperative of the bridging roles highlighted by foregrounding phronesis, and thereby potentially building momentum over time that subverts the paralysis of standoff between crusaders and pragmatists into a productive mutual softening of both positions into a pragmatic radicalism (*Cf* Von Hellerman, Contribution 5) and an experimental pragmatism, respectively.

5. Conclusions

Altogether, the Special Issue presents an informative collection on this key issue of local government climate action, from which we have here presented an initial attempt at a conceptual synthesis: namely the (perhaps surprising) centrality of 'phronesis', or situated strategic-ethical wisdom, for local government tackling this issue. Reading the various contributions in this light, we have also argued, proves to be illuminating and corroborates this novel synthesis. However, as already emphasized above, we do not wish to claim that all the authors explicitly endorse this position and we invite readers to explore for themselves the extent to which the thesis of the centrality of phronesis is confirmed—or not—by these articles, and in their own research and experience. At the least, we hope to have hereby helped in some way with the important ongoing work of formulating a new and practicable paradigm of understanding to replace existing and outdated approaches and dominant but inadequate common senses that currently complicate further the complex challenges of local government climate action.

6. List of Contributions

1. Yuille, A.; Tyfield, D.; Willis, R. Implementing Rapid Climate Action: Learning from the 'Practical Wisdom' of Local Decision-Makers. *Sustainability* **2021**, *13*, 5687, doi:10.3390/su13105687.
2. Valdivieso, P.; Neudorfer, P.; Andersson, K.P. Causes and consequences of local government efforts to reduce risk and adapt to extreme weather events: Municipal organizational robustness. *Sustainability* **2021**, *13*, 7980, doi:10.3390/su13147980.
3. Peirson, A.E.; Ziervogel, G. Sanitation upgrading as climate action: Lessons for local government from a community informal settlement project in cape town. *Sustainability* **2021**, *13*, 8598, doi:10.3390/su13158598.
4. Russell, E.; Christie, I. The remaking of institutions for local climate governance? Towards understanding climate governance in a multi-level UK local government area: A micro-local case study. *Sustainability* **2021**, *13*, 13817, doi:10.3390/su132413817.

5. von Hellermann, P. From Ecophany to Burnout? An Anthropologist's Reflections on Two Years of Participating in Council-Citizen Climate Governance in Eastbourne. *World* **2021**, *2*, 521–537, doi:10.3390/world2040032.
6. Drummond, P. Assessing city governance for low-carbon mobility in London. *Sustainability* **2021**, *13*, 1–24, doi:10.3390/su13052480.
7. Kwon, M.; Mlecnik, E.; Gruis, V.H. Business Model Development for Temporary Home Renovation Consultancy Centres: Experiences from European Pop-Ups. *Sustainability* **2021**, *13*, 8450, doi:10.3390/su13158450.
8. Marsden, G.; Anable, J. Behind the targets? The case for coherence in a multi-scalar approach to carbon action plans in the transport sector. *Sustainability* **2021**, *13*, 7122, doi:10.3390/su13137122.

Author Contributions: Conceptualization, D.T. and A.Y.; writing—original draft preparation, D.T. and A.Y.; writing—review and editing, D.T. and A.Y.; visualization, D.T.; supervision, D.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research of compiling this editorial received no external funding. The work associated with the individual contribution of the authors to this Special Issue was funded by the UK's Economic and Social Research Council (ESRC) through the Place-Based Climate Action Network (P-CAN), grant number ES/S008381/1.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Romsdahl, R.; Blue, G.; Kirilenko, A. Action on climate change requires deliberative framing at local governance level. *Clim. Chang.* **2018**, *149*, 277–287. [CrossRef]
2. Willis, R.; Curato, N.; Smith, G. Deliberative democracy and the climate crisis. *Wiley Interdiscip. Rev. Clim. Chang.* **2022**, *13*, e759. [CrossRef]
3. Romsdahl, R.J. Deliberative framing: Opening up discussions for local-level public engagement on climate change. *Clim. Chang.* **2020**, *162*, 145–163. [CrossRef]
4. Dessler, A.E.; Parson, E.A. *The Science and Politics of Global Climate Change: A Guide to the Debate*, 3rd ed.; Ambridge University Press: Cambridge, UK, 2020.
5. Biermann, F. *Earth System Governance: World Politics in the Anthropocene*; MIT Press: Cambridge, MA, USA, 2014.
6. Hickman, L. James Lovelock: Humans Are Too Stupid to Prevent Climate Change. Available online: https://www.theguardian.com/science/2010/mar/29/james-lovelock-climate-change (accessed on 4 April 2022).
7. Li, Y.; Shapiro, J. *China Goes Green: Coercive Environmentalism for a Troubled Planet*; Polity Press: Cambridge, UK; Medford, MA, USA, 2020.
8. Flyvbjerg, B.; Landman, T.; Schram, S. *Real Social Science: Applied Phronesis*; Cambridge University Press: Cambridge, UK, 2012.
9. Muldoon-Smith, K.; Sandford, M. Grasping the nettle: The central-local constraints on local government funding in England. *Territ. Politics Gov.* **2021**, 1–18. [CrossRef]
10. O'Brien, P.; Pike, A. 'Deal or no deal?' Governing urban infrastructure funding and financing in the UK City Deals. *Urban Stud.* **2019**, *56*, 1448–1476. [CrossRef]
11. Shearer, E. *Will the Levelling up Missions Help Reduce Regional Inequality?* Institute for Government: London, UK, 2022.
12. Blumer, H. What is Wrong with Social Theory? *Am. Sociol. Rev.* **1954**, *19*, 3–10. [CrossRef]
13. Bateson, G. *Steps to an Ecology of Mind: Collected Essays in Anthropology, Psychiatry, Evolution, and Epistemology*; Intertext: Aylesbury, UK, 1972.
14. Heffron, R.J. *Achieving a Just Transition to a Low-Carbon Economy*; Palgrave Macmillan: Cham, Switzerland, 2021. [CrossRef]
15. Tyfield, D. Phronesis (and its potentially central contribution to mobilities research in the twenty-first century). In *Handbook of Research Methods and Applications for Mobilities*; Buscher, M., Freudendal-Pedersen, M., Kesselring, S., Grauslund Kristensen, N., Eds.; Edward Elgar Publishing: Cheltenham, UK; Northampton, MA, USA, 2020; pp. 345–353.
16. Schram, S.F.; Flyvbjerg, B.; Landman, T. Political Political Science: A Phronetic Approach. *New Political Sci. Stud. Politics Today: Crit. Approaches Political Sci.* **2013**, *35*, 359–372. [CrossRef]
17. Foucault, M. *Power/Knowledge: Selected Interviews and Other Writings, 1972–1977*, 1st ed.; Pantheon Books: New York, NY, USA, 1980.
18. Foucault, M. *"Society Must Be Defended": Lectures at the Collège de France, 1975–1976*; Penguin: London, UK, 2004.
19. Sotarauta, M.; Suvinen, N.; Jolly, S.; Hansen, T. The many roles of change agency in the game of green path development in the North. *Eur. Urban Reg. Stud.* **2021**, *28*, 92–110. [CrossRef]
20. Lewis, T. Car-Free Neighbourhoods: The Unlikely New Frontline in the Culture Wars. Available online: https://www.theguardian.com/lifeandstyle/2020/nov/01/car-free-neighbourhoods-the-unlikely-new-frontline-in-the-culture-wars (accessed on 6 April 2022).

21. McIntyre, N. Traffic Wars: Who Will Win the Battle for City Streets? Available online: https://www.theguardian.com/news/2021/mar/25/traffic-wars-who-will-win-the-battle-for-city-streets (accessed on 6 April 2022).
22. Rosa, H.; Trejo-Mathys, J. *Social Acceleration: A New Theory of Modernity*; Columbia University Press: New York, NY, USA, 2013.
23. Du Gay, P. *In Praise of Bureaucracy: Weber-Organization-Ethics*; SAGE Publications: London, UK, 2000.
24. Tyfield, D.; Ely, A.; Geall, S. Low Carbon Innovation in China: From Overlooked Opportunities and Challenges to Transitions in Power Relations and Practices. *Sust. Dev.* **2015**, *23*, 206–216. [CrossRef]
25. Tyfield, D. *Liberalism 2.0 and the Rise of China: Global Crisis, Innovation and Urban Mobility*; Routledge: London, UK, 2018.
26. Taleb, N.N. *Antifragile: Things that Gain from Disorder*; Penguin: London, UK, 2013.
27. Schweitzer, A. *The Decay and the Restoration of Civilization*, 2nd ed.; A. & C. Black, Ltd.: London, UK, 1955.
28. Kripal, J.J. *The Flip: Who You Really Are and why It Matters*; Penguin: London, UK, 2020.
29. Graham, S.; Marvin, S. *Splintering Urbanism Networked Infrastructures, Technological Mobilities and the Urban Condition*; Routledge: London, UK; New York, NY, USA, 2001.
30. Florida, R. *The New Urban Crisis: Gentrification, Housing Bubbles, Growing Inequality, and What We Can Do about It*; One World: London, UK, 2017.
31. Star, S.L. The Ethnography of Infrastructure. *Am. Behav. Sci.* **1999**, *43*, 377–391. [CrossRef]
32. Taylor, C. *Modern Social Imaginaries*; Duke University Press: Durham, NC, USA, 2004.
33. Jasanoff, S.; Kim, S.-H. *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*; University of Chicago Press: Chicago, IL, USA, 2015.
34. Bristow, J.; Bell, R.; Wamsler, C. *Reconnection: Meeting the Climate Crisis Inside out (Consultation Draft)*; Mindfulness Initiative and LUCSUS: Sheffield, UK, 2022.
35. Van der Heijden, J. Studying urban climate governance: Where to begin, what to look for, and how to make a meaningful contribution to scholarship and practice. *Earth Syst. Gov.* **2019**, *1*, 100005. [CrossRef]

sustainability

MDPI

Article

Implementing Rapid Climate Action: Learning from the 'Practical Wisdom' of Local Decision-Makers

Andy Yuille *, David Tyfield and Rebecca Willis

Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, UK; d.tyfield@lancaster.ac.uk (D.T.); r.willis@lancaster.ac.uk (R.W.)
* Correspondence: a.yuille1@lancaster.ac.uk

Abstract: A global goal to limit dangerous climate change has been agreed through the 2015 Paris Accords. The scientific case for action has been accepted by nearly all governments, at national and local or state level. Yet in all legislatures, there is a gap between the stated climate ambitions and the implementation of the measures necessary to achieve them. This paper examines this gap by analysing the experience of the following three UK cities: Belfast, Edinburgh, and Leeds. Researchers worked with city officials and elected representatives, using interviews and deliberative workshops to develop their shared understandings. The study finds that local actors employ different strategies to respond to the stated climate emergency, based on their innate understanding, or 'phronetic knowledge', of what works. It concludes that rapid climate action depends not just on the structures and mechanisms of governance, but at a deeper level, the assumptions, motivations and applied knowledge of decision-makers.

Keywords: climate change; politics; local climate action; local government; climate emergency; phronesis; practical wisdom; crisis; UK

Citation: Yuille, A.; Tyfield, D.; Willis, R. Implementing Rapid Climate Action: Learning from the 'Practical Wisdom' of Local Decision-Makers. *Sustainability* **2021**, *13*, 5687. https://doi.org/10.3390/su13105687

Academic Editor: Dalia Štreimikienė

Received: 25 March 2021
Accepted: 13 May 2021
Published: 19 May 2021

1. Introduction

A large majority of decision-makers in local, state-level and national governments are committed to acting on climate change. Following the Paris Accords of 2015, the findings of the Intergovernmental Panel on Climate Change in their 'special report' of 2018 [1] and global climate protests and school strikes, many legislatures, including the UK, France, Canada, Ireland and many local governments, made a formal declaration of a 'climate emergency'. These declarations can be seen as an acknowledgement of the gravity and urgency of the climate crisis. They are often accompanied by a 'net zero' target for greenhouse gases (GHGs), reducing emissions as far as possible and compensating for any remaining emissions through the removal of GHGs from the atmosphere.

The stage is set, then, for ambitious climate action. Yet, it is increasingly apparent that a gap is opening up between the stated intentions and the action necessary to achieve them [2,3]. Many explanations have been put forward for this gap, from the view that the fundamental growth imperative of capitalist accumulation is not compatible with the emission reduction [4,5] to more technical analyses that suggest, for example, that the costs of GHG pollution are not currently factored into decision-making, and that economy-wide carbon taxes are required [6]. Yet a recent survey of climate governance research [7] revealed that, while questions of technical governance and policy design have been well studied, there has been less attention paid to the crucial issue of how such solutions might be implemented, and by whom. An earlier study [8] (p. 755) notes that there is a limited understanding of the role and motivations of senior decision-makers (SDMs) in climate governance: "despite the important role of SDMs, many analyses of the climate change problem gloss over them".

This paper thus focuses on a neglected area of research, which is the lived experience and understandings of local decision-makers. Building on earlier work examining the

attitudes and motivations of national politicians [9], the paper reports on a study of officials and elected representatives in three UK cities, Belfast, Edinburgh and Leeds. Researchers worked with local decision-makers to learn from their practical skills and know-how, as individuals responsible for the implementation of ambitious declarations and targets.

The paper begins by discussing the theoretical approach that informs the methodology and analytical orientation of the research, emphasizing the importance of 'phronetic knowledge' [10], or implicit understandings that professionals have about the possibilities and constraints of their role. These insights are discussed in detail in Section 2 below. The theoretical orientation of this study informs the method, which is described next: qualitative, semi-structured interviews with officials and elected representatives in each city, followed by small deliberative workshops offering researchers and city stakeholders the opportunity to reflect together on the study's findings. This allowed the academic researchers and policy professionals to learn together, with both providing their own contextualised expertise. Thus, all involved could reflect, collaborate and innovate their practice. Data from interviews and workshops were analysed iteratively, through two levels of analysis. First, the stated barriers and enablers of climate action were drawn out. The second stage was an inductive identification of distinct patterns in participants' working strategies and their interactions with each other.

Turning to the results, at the first level of analysis, the study confirmed that climate change now has a high political priority across the three cities, and that this has significantly increased in recent years; however, a gap is opening up between the stated ambitions and the plans to achieve them. A particular problem is the lack of clarity over the division of responsibilities between the national and local governments, and, given the UK governance context, the lack of powers and resources at a local level, which limits the ability of local areas to act. Whilst participants tend to stress the importance of collaboration between officers and politicians, between different departments and between political parties, the research finds that perspectives on the same issues varied, often radically, within an organization.

At the second, deeper level of analysis, the focus shifts from the *what* of the challenges, opportunities, progress and barriers relating to rapid climate action, to *how* these factors are engaged with as part of the participants' everyday working lives. The patterns in working practices were identified and categorised, as follows:

- 'Crusaders' seek to embed climate action in the council and beyond, seeing their role as 'getting the message out' and 'changing the culture'. They work strategically to establish climate action as an urgent priority that cannot be sidelined, and to shift the accepted range of what is achievable;
- 'Entrepreneurs' use their knowledge of the existing concerns, situations and ways of working to seek out opportunities to promote climate action. They look for synergies with existing programmes and priorities and try to link the strategic to everyday routines and decisions;
- 'Pragmatists' recognise the importance of the climate agenda, while retaining a strong focus on pre-existing personal and council objectives and how strategic ambitions can or cannot be delivered through existing procedures;
- 'Weavers' focus on collaboration and connections, aiming to mesh together agreed-upon high-level aims with the specific contested measures needed to achieve them, and to build and maintain trust and support.

The study concludes that the successful development and implementation of climate strategies at local level will require a sustained focus, not just on what needs to be done, but on how local decision-makers can find their way through a conflicting and sometimes contradictory governance landscape.

2. Methodology

2.1. Theoretical Orientation

The research presented here is informed by a particular theoretical orientation that emphasises the importance of understanding the context of decision-making within institutions, and particularly the lived experience of the individuals involved. This is explained below, with reference to the following three linked concepts: transductive analysis; 'phronetic' knowledge; and understandings of crisis, particularly relevant to the government of 'climate emergency'.

As outlined in the introduction, many national and local governments have committed to ambitious climate strategies, but a gap has opened up between those ambitions and their implementation. In analysing this gap, scholars tend to adopt one of two broad methodologies, which may be loosely characterised as 'realist' or 'idealist'. In both cases, research proceeds by exploring what is currently the case and why, before suggesting solutions to the problems thus defined. In realist analysis the entire enterprise, and especially the suggestion of ways forward, prioritises what seems 'realistic' given the understanding and problem definition. This thus includes the vast majority of (social) scientific literature on climate action. Idealist analysis, conversely, tends to adopt a more explicitly normative stance in both its problem diagnosis and subsequent recommendations. Its analysis may thus tend towards 'deeper' causes and be less focused on specific issues, measures or interventions. For instance, it may offer a system-level critique of current political and economic practices, asserting that only change at this system-level can achieve climate ambitions, and advocating a new political or social settlement [4,11]. Despite their very different orientations, though, the realist and idealist approaches have a shared tendency for their desire for solutions to dominate the whole exploration, setting up a scramble to reach these conclusions. These ways forward also emerge as a final speculative jump in the analysis, with the proceeding analysis the 'run up' supposedly on sure ground.

We argue, however, that the nature of the climate crisis requires a much fuller and enduring examination of the state we are in. The climate emergency is a profound crisis, challenging settled common senses and ways of thinking and doing [12,13]; an experience perfectly exemplified by the dissonance arising from acknowledging, or even actively campaigning for the declaration of climate emergency—and then not knowing what to do about it. Such sentiments are evident, and increasingly documented [14] across all tiers and forms of government, as well as in business and civil society.

Such paralysis urgently invites a different approach to the problem. The fact that so many interested and committed decision-makers find themselves in this situation suggests prevailing modes of seeking ways forward offer little guidance. Rather than directly searching for solutions, as realist or idealist positions might, this paralysis invites a shift towards examining the predicament itself with a strategic lens, going *into* it to illuminate what is already the case. This can be called a 'transductive' form of analysis, drawing out lessons by going *through* a careful and strategic exploration of the present. It can be contrasted with the more familiar deductive or inductive forms of reasoning—or, indeed, abductive or retroductive forms [15]—that typify realist or idealist approaches, which draw on evidence to formulate lessons in the light of what is already deemed known and/or wanted.

Dominant approaches to analysis necessarily ground such learning foundationally in existing cognitive frameworks. Yet confronted with paradox and paralysis, it is precisely these latter that are the problem. In contrast, transductive analysis opens up rethinking of existing paradigms by diving deeper into an appreciative [16] and pragmatic characterisation of the predicament, to explore and reflect upon how things are currently constituted, how they 'work' or 'fail' (and for whom), and how different actors, and their practices, are implicated.

In this approach, a key to effective mobilization of settled paradigms is an emphasis on learning from the (possibly tacit, likely contradictory) understandings of those embedded within the situation under study, focusing on practical wisdom or 'phronesis'. The

term 'phronesis' refers to an Aristotelian categorisation of knowledge, described as "the practical wisdom that emerged from having an intimate familiarity of what would work in particular settings and circumstances" [17] (p. 369). As such, it can be distinguished from episteme (universal knowledge) or techné, (practical application of knowledge). In a recent revitalization of this concept, though, this practical wisdom also has specific concern for the irreducible power relations that condition, and are constituted by, any body of knowledge [18].

Following this approach, this study aims to uncover the phronetic knowledge of those active in local government as a promising avenue to break the current deadlock in climate action at this key scale. It scrutinises their innate understandings of the possibilities and constraints of their role, or what Sanford Schram and colleagues refer to as "the 'unconsciously competent' expertise that ought to be part of the scholarly endeavour" [17] (p. 371) (see also [19]). Thus, the study extends beyond the *'what'* of the challenges, opportunities, progress and barriers relating to rapid climate action, to focus primarily on *how* these factors were engaged with as part of participants' everyday working lives, drawing on their lived experience of addressing them within particular cultural, historical and institutional contexts. This then encourages imaginative, engaged and constructive reassessment by actors themselves of how they are currently working and what they could do differently for more effective pursuit of their goals. Focusing on what is already the case and the opportunities to draw on a 'bricolage' of what is already 'to hand' in novel combinations [20,21] also then enables optimal practicality in the ensuing insights, not least by 'working with the grain' of existing power relations.

It is particularly important to use this phronetic approach in this case because of the profound nature of the climate crisis, or climate emergency. For this is not just a matter of environmental limits, but also links to crises of an emergent society [22] that is new in multiple and profound ways, e.g., as planetary [23], global and cosmopolitised [24,25], and constituted by post-human technologies and nature-cultures [26,27]. Our ability to move forward on climate change is intricately linked to our confidence in the ability of the government—both national and local—to understand its predicament and use its powers wisely. Yet in such unprecedented circumstances this capacity is significantly attenuated.

Following Debray [28], political economist Bob Jessop argues that crises are "complex, objectively overdetermined moments of subjective indeterminacy, where decisive action can make a major difference to the future" [29] (p. 247). They are 'objectively overdetermined' in that there is no single definitive set of causal factors that can be identified as the 'root cause' of the crisis. They are 'subjectively indeterminate' in that there are multiple interested interpretations of the crisis, many of which may yet be proven 'correct' depending on the course of action taken in response and which groups are thereby empowered. In both respects, then, there is no single objective fact of the matter for a standard realist/idealist approach to illuminate first, before handing it over to practical decision-makers. The irony is thus that in such a moment of crisis, seeking the refuge (perhaps with urgently renewed zeal) of the sure grounds of conclusive fact tends only to exacerbate epistemic disorientation and so practical paralysis.

In crises, therefore, a different and strategic approach, working from existing tacit practical understanding, is not only more promising but arguably essential. The importance of this approach regarding the governance of climate emergency is even more striking once we admit, as above, that climate crisis overlaps and threatens to feed into other forms of system crisis, including crises of authoritative knowledge, of state institutions and even of governmental legitimacy. In short, the paralysis on the governance of climate emergency is tenable only for so long, and with the stakes high indeed, not least for the very institutional preconditions of any hope of effective climate action.

In this research, therefore, we work with those actors who are in the midst of responding to the 'climate emergency' and specifically burdened with governmental responsibility to do so. We make explicit their phronetic understanding both of the crisis and of the

institutions that are required to respond, in order to help with finding locally appropriate ways forward.

2.2. Data Collection and Analysis

In keeping with the theoretical orientation described above, the study methodology was designed to elicit the 'phronetic knowledge' of officials and politicians in local government, across the following three UK cities under study: Belfast, Edinburgh and Leeds. These cities form part of the Place-Based Climate Action Network (PCAN), a network of academic, policy and business stakeholders, co-ordinated by the London School of Economics and dedicated to translating climate policy into action 'on the ground'. PCAN provided the funding for this project. All three cities are covered by the UK Government's legally binding national target of achieving net zero by 2050. This target was introduced in June 2019 in an advance from the previous target of at least an 80% reduction from 1990 levels by 2050. The UK Government does not at the time of writing have a specific climate strategy, rather its approach to emissions reduction is embedded across a range of different strategies, e.g., industrial strategy, clean growth strategy, resources and waste strategy, and more recently a 'ten point plan for a green industrial revolution'. As cities in the devolved nations of Northern Ireland and Scotland, respectively, Belfast and Edinburgh also have a tier of devolved national government between the city council and the UK Government, with their own climate-relevant policies. The Scottish Government has set a net zero target for 2045, while Northern Ireland does not have a nation-specific emissions reduction target, but must contribute to achieving the overall UK target. Leeds (in England, which does not have a devolved national government), is only covered by UK Government policies.

Local governments have a range of statutory responsibilities with significant impacts on emissions (e.g., spatial planning, transport planning (except in Northern Ireland), waste collection and disposal, education and social housing provision (both involving an estate of largely older, energy inefficient buildings) and social care (involving substantial travel by employees). They also have a range of non-statutory responsibilities, e.g., provision of leisure and recreation facilities, including parks and green spaces. As well as cutting emissions from their own estates and operations, some councils (including the three cities in this study) are also putting in place strategies, mechanisms and targets for reducing emissions from the territory that they govern as a whole, including the public and private sector and household emissions. One mechanism to facilitate this are PCAN 'Climate Commissions', which bring together key city stakeholders with the council to collaborate on city-wide emissions reduction.

While climate change has featured as a consideration in some local government activities for several years (e.g., transport and spatial planning), it is only very recently that this has become a significant priority for them, and in most cases local climate plans and strategies are only now emerging, so their impacts cannot yet be quantitatively assessed. The climate strategies of each city council in this study have been informed by 'mini-Stern reviews', which assessed the cost and carbon effectiveness of a wide range of the low carbon options that could be applied at the local level in households, industry, commerce and transport, and explored the scope for their deployment, the associated investment needs, financial returns and carbon savings, and the implications for the economy and employment. However, even in those areas where the local government has responsibility (e.g., transport and spatial planning), they operate within a policy framework set by the national and devolved governments, which constrains their scope for action.

In Table 1 we set out some of the relevant organizational and governance context of the cities in this study.

The phronetic approach is not intended to assess the appropriateness of these strategies or targets, nor to measure progress towards implementing or achieving them, but rather to explore how, in practice, key actors within these institutions engage with them and integrate them within everyday working practices that are also subject to a wide range of other pressures, priorities and responsibilities.

Table 1. City councils' organisational and governance context.

	Belfast	**Edinburgh**	**Leeds**
Climate emergency	Declared October 2019	Declared May 2019	Declared March 2019
City-wide emissions target	Quantitative target due to be set in 2021	Net zero by 2030	Net zero by 2030, with emissions halved by 2025
Strategy in place	City-wide net zero roadmap published December 2020 (aligned to UK 2050 target)	Immediate action plan to reduce council emissions published October 2019; city-wide net zero roadmap published December 2020	City-wide net zero roadmap published April 2019; updated January 2020
Political context	Neither nationalist (supporting a united Ireland), nor unionist (supporting continued British rule of Northern Ireland) parties have a majority.	Council controlled by a minority Scottish National Party/Labour coalition, with the Conservatives the largest party in opposition.	Council controlled by one party (Labour), with a large majority.
Climate Commission	Established January 2020	Established February 2020	Established September 2017

The methodology followed an iterative process, beginning with interviews, which were coded and analysed, with findings presented back to small groups of stakeholders through online workshops, where they were discussed and refined. The workshops were then analysed, and conclusions and recommendations drawn out. Each of these stages is described below. All interviews and workshops were carried out online. Ethics approval was sought and granted by Lancaster University Faculty of Science and Technology Ethics Committee. The interviews and workshops were held under conditions of anonymity, so the data from this study is not available as a dataset. Given the small sample size and the need for anonymity, we have not attributed the quotes used in the results section in any way.

Interviews: Five individuals from each city were recruited, following advice from local researchers involved in PCAN. In each city, we interviewed two elected representatives, i.e., local politicians, and three senior officials. In each city, we included those who had direct responsibility for climate strategy (for example, a politician chairing a climate working group or an official responsibible for council-wide sustainability policy) and those working in areas where policies are necessary to drive carbon reduction, such as transport, planning, housing and economic development. Interviews were qualitative and semi-structured, using a narrative approach [30], and were conducted as an exploratory conversation. Participants were offered anonymity. The interview questions covered the responsibilities of that individual's role, their sense of 'what works' in policymaking, their views on how climate change is factored into policy decisions, and what is needed to allow rapid climate action. Interviews were recorded, transcribed and coded using the Atlas-ti programme.

Workshops: Findings from the interviews were summarised into a discussion paper. Through the PCAN network, each city was offered the opportunity of a workshop. Workshops were held in two of the three cities, Belfast and Leeds, with Edinburgh stakeholders declining the offer due to resource issues during the COVID-19 pandemic. At the workshops, the findings of the interviews were presented, and small-group discussions and creative visualisation techniques were used to encourage reflection and phronetic learning on the part of all participants, including the researchers. Participants compared the differing viewpoints held by different actors, in order to develop a deeper understanding of how climate-relevant decisions are framed and made, and to put forward proposals for change. Participants included interviewees, other city stakeholders, PCAN team members, and the project team, with 12–15 participants in total in each workshop. The workshops were held online, using the Zoom platform.

Engagement and dissemination: An anonymised report of findings was prepared, looking at the specific circumstances of each city, and drawing out commonalities. This was disseminated through a webinar, through the PCAN network and through networks in each city. Results are summarised in the following section.

3. Results

The theoretical orientation of this paper informs the presentation of the results. We start by reporting the 'what' of responding to the climate emergency, which includes the enabling and constraining factors reported by the participants. We then dig deeper into the 'how', exploring how the participants understood and navigated these factors, and what strategies they employed to try to make progress against their own goals and those of their organisation, in the context of responding to the climate emergency.

3.1. Enabling and Constraining Factors—The 'What'

Across the three cities, common themes emerged from the interviews with both officers and politicians to explain the progress they had made, the scale of the challenge still facing them, and the difficulties and opportunities they encountered or foresaw in pursuing their locally agreed climate strategies and targets. These themes were confirmed and developed further in the deliberative workshops. They are summarised at a very high level in Table 2 and developed in the following text, illustrated with direct quotations from participants (inset and italicised).

Table 2. Key enabling and constraining factors.

Theme	Key Finding
Political priorities	Climate now higher up political agenda
Ambition v implementation	Limited understanding of how climate goals will be achieved
National-local interaction	National policies constrain local action
Organisational culture	Alignment on climate agenda not yet established within or beyond city councils
Framing the issue	Need to present climate action as mainstream choice with multiple benefits
Devil in the detail	High-level support undermined by contentious local implementation
COVID-19 risks/opportunities	Opportunity to 'build back better', but risk of return to 'economy first, environment later' model
Place-based approaches	Climate action understood as locally specific and embedded in meaningful and symbolic elements of place

Political priorities: Climate protests, widespread media coverage, and increases in vocal public concern have shifted what is possible and necessary for councils to do, triggering the declaration of climate emergencies and creating a context in which the development of local emissions reduction targets and strategies to achieve them became widely accepted as important. Public support and strong senior political and officer leadership on climate action are vitally important, especially when particular policies or initiatives might be unpopular.

> *"The profile given to climate change has removed the scales from some people's eyes or elevated it in terms of their political priorities."*

Ambition vs. implementation: Despite the ambitious commitments set out in the locally agreed strategies, and a broad understanding that every aspect of the council's work would have to align with the net zero target, there was no real understanding of how this agenda would be incorporated into service delivery plans and reported against. There was a shared feeling of moving into uncharted, experimental waters [31].

"The price for most officers [of an ambitious target] is we can't see the path to that."

National–local interaction: The councils have huge potential to drive emissions reductions but currently lack the powers, funding, and statutory responsibility to do so. Policies and procedures, often nationally imposed (e.g., in planning, housing and transport) severely restrict the local government's ability to prioritise carbon reduction, linked to a perceived lack of national leadership [32].

"The main dilemma for any local authority is, none of this is statutory. We have no piece of legislation that says we need to do this."

Organizational culture: A highly collaborative and aligned approach prioritising the decarbonisation agenda is needed both within the councils (between officers and politicians, different departments, and political parties) and with wider stakeholders [33,34]. This approach was not yet in place, although the PCAN Climate Commissions were perceived as making positive progress. However, radically divergent perspectives remained even within institutions, e.g., on whether a council's strategic framework helped or hindered delivering the climate agenda, or whether local political configurations have made progressive action easier or harder. External expertise and partnerships were often seen as key drivers in pushing councils to develop ambitious decarbonisation commitments [35].

"Even though there is a lot more consensus now than there was even two or three years ago, we're still not necessarily all pointing in the same direction."

Framing the issue: Framing climate action [36] in terms of its co-benefits—e.g., reducing fuel poverty, generating jobs, and improving air quality and public health—is an important route to securing political and public support [37,38]. To achieve significant change, climate action has to be understood as the best, mainstream course of action/investment, rather than a 'green alternative'. Politicians and officers agreed that once the high-level political decisions have been made, officers need to present and frame evidence and options that will help politicians make the 'right' choices in that context; both officers and politicians have political agency [39].

" . . . positioning green action as just the best action to take. Not green, but actually the best choice... So the risk of not doing this is greater than the cost of doing it; the opportunity of it is greater than the uncertainty you face right now."

Devil in the detail: The widespread political, officer and public support for the 'big ideas' of tackling the climate emergency can quickly be reversed in specific, contentious instances, e.g., public resistance to reallocating road space, or political decisions that support jobs but increase emissions. This can derail individual projects, and cumulatively threaten the achievement of targets, take up significant officer and politician energy, and generate aversion to future interventions.

"It's the difference between, a lot of people take on board the overall concept that we need to do something about it but they're not necessarily taking that ownership or making that change themselves. I think that's where we struggle to get buy in and support."

COVID-19 risks/opportunities: The recovery from Covid-19 provides opportunities to drive change, building on learning from the response to the crisis and the potential of the stimulus package, but it also risks the re-emergence of an 'economy first' approach. As emissions reduction is not a statutory duty for local government, it has been squeezed as an objective by austerity [40] and is likely to be even more so during the recovery from COVID-19.

"As we're beginning to think about coming out of COVID and recovery, people are saying the right things: we don't want to go back, we want to build back better, this is an opportunity . . . [but] saying it and meaning it when jobs and growth are in question are two different things."

Place-based approaches and narratives: A theme that emerged specifically from the workshops was an emphasis on climate action as locally specific. Appeals to abstract or

generalised quantifications, and high-level science and policy, were not seen as persuasive to publics or policymakers. Driving rapid change through locally determined strategies requires making explicit connections with meaningful and symbolic elements of place and developing culturally specific narratives, as well as reflecting spatially specific challenges and opportunities; the city's relation to climate action must be understood and communicated in terms of a lived place as well as an abstract space [41]. This required local government leadership across a range of place-based dimensions, and a concomitant need for associated powers and resources to be devolved at the local level. This is not a matter of 'glorifying the local', but emphasises that implementing rapid climate action in specific locations is not simply a matter of applying national targets at a local level.

> *"We are going to have to tell compelling attractive locally understandable stories about climate action, and we can't just depend upon the language of science and science-driven targets and policy deadlines, these will not land . . . [we need a] way of indigenising this, localising it and using colloquial language and stories . . . to make this really local and tangible for people. I do think that the policy and science stuff, we need it but it ain't going to sell it."*

3.2. Personas and Strategies–The 'How'

The results described above broadly aligned with the authors' expectations from contextual background research, experience of working with local government in various professional capacities, and existing literature [42,43]. However, as described in Section 3 above, the phronetic approach taken in this study calls for the analysis to extend beyond the *'what'* of the challenges, opportunities, progress and barriers relating to rapid climate action, to *how* these factors were engaged with as part of participants' everyday working lives. Insights about the 'how' can then in turn re-situate the insights about the 'what' and make them available to be engaged with differently.

As set out above, iterative analysis of interview transcripts led to the inductive identification of distinctive patterns in the participants' working practices, and their interactions with others in relation to local strategies and targets for climate action. We categorised these patterns into four 'personas', as set out in Table 3. These describe the ways in which people engaged with the problem of rapid climate action, which we labelled as crusaders, entrepreneurs, pragmatists and weavers. We followed the principles of phronetic social science in developing these by focusing on the context of specific situations, the values held by the actors embedded in those situations, the production and distribution of power (or agency) in those situations, and generating an active dialogue with relevant publics (interviewees and other key stakeholders within the councils and cities) [44].

Table 3. Ways of engaging with the climate agenda.

Persona	Defining Characteristic
Crusader	Seeks to establish climate action as an urgent priority
Entrepreneur	Seeks to integrate climate with existing programmes and priorities
Pragmatist	Seeks to deliver climate action within existing policy and procedural framework
Weaver	Seeks to build widespread support for climate action

These personas were not articulated explicitly by interviewees themselves, but were drawn directly from their accounts of lived experience and their practical responses to concrete situations 'on the ground'. The presence of these categories as distinct and recognisable ways of working, and the practical utility of using them as a framework to think through individual and institutional responses to the challenge of climate change, were confirmed by participants in the deliberative workshops, as follows:

> *"The typology is really helpful because . . . as we think over the next few years about this, we need to be really focused on do we have enough of that mix."*

> *"Those characterisations did really resonate with me when I think about types of people we work with in the council and how things are now . . . it then presents the opportunity to be able to understand why someone's behaving like that, potentially moving them into different ways of thinking and . . . bake things in more effectively."*

The personas were enacted in the responses of both the officers and politicians. Individuals may enact different personas at different times and in different circumstances, although they may have a disposition towards performing one or more particular personas. They may be consciously decided upon as a strategy, observed by individuals themselves but without prior intent to act in that way, or performed unreflexively. Below we provide a brief summary of the main characteristics of each persona, exemplified by illustrative quotations from the participants.

Crusaders see their mission as embedding rapid climate action in the work of the council and beyond. They work at a strategic level, within and/or across departments and portfolios as well as with external stakeholders. They see their role as 'getting the message out' and 'changing the culture', driving a shift in strategic focus in order to establish climate action as a real and urgent priority for action that can't be ignored, sidelined or compromised away. They attempt to shift the so-called 'Overton window' of policies and actions that are politically acceptable [45]—although their main target audiences are policymakers and other influential stakeholders, rather than the general public.

> *"I'm plugging away at that and that's going to take me a while to get that change to really be embedded in but it's a drip drip. I've got to persuade the officers in the council, I've got to persuade the elected members, I've got to persuade other people."*

However, 'crusading' language and action can also alienate audiences and risks the crusader being seen as disconnected from the mainstream, which can reduce their scope for impacting policy agendas—and fear of this can constrain people from adopting 'crusading' stances [9]:

> *"The approach is often counterproductive as well, I sometimes feel. The kind of campaigning, crusading approach sometimes can end up either boring people or alienating people, I guess."*

Entrepreneurs are agile and use their knowledge of existing ways of working, agendas and situations to seek out opportunities to promote climate action. They look for synergies with existing programmes and priorities, and show how they can be delivered together with climate action. They try to link the strategic to everyday routines and decisions, and try to address or avoid the obstacles of implementation in sometimes indirect ways. They tend to operate within the existing 'Overton window' to find openings that can be used to further the climate agenda.

> *"How we weave the climate into that, in terms of that being perceived as an opportunity and a positive thing."*

Such an approach, however, runs the risk of climate action getting 'lost' and diluted in amongst other priorities. It can generate a sense of climate being just another factor to be added to existing activity, rather than an existential threat:

> *"If you politically mainstream it that de-radicalises it, which is good because it means more people get around the table. But my sense is that within the policy articulation of this it's seen as, 'Oh, it's a normal policy process', when it is anything but."*

Pragmatists recognise the importance of climate action, but also maintain a strong focus on pre-existing objectives and may resist what they perceive as the colonisation by climate of other agendas. They are often engaged with the details and decisions around the implementation or scrutiny of policy impacts, and have a strong focus on process and procedure.

> *"My team do get quite frustrated that what seems like a good idea and gets put into a strategy isn't really thought through with all of the consequences because they're not*

> *responsible for that delivery side. It's easier to write a strategy that sounds good without actually then having to think about how it gets implemented."*

This persona was particularly identified as potentially generating barriers to action through a reliance on policy frameworks, procedures, and established custom and practice, which may take a long time to change in line with institutional ambitions.

> *"You've got senior civil servants who are dead competent civil servants but they're to a person they're pragmatists. So unless there's something that makes them change what they want to do or what they have to do, they're not going to change."*

Weavers focus on collaboration and connections between levels (macro and micro) and between stakeholders (within and external to the council). They aim to mesh together easily agreed high-level aims with the disputed and contested concrete measures needed to achieve them. They are concerned with building and maintaining trust and support (from publics, politicians, officers and other stakeholders). They bring together ideas, approaches and people that may otherwise conflict and attempt to 'weave' solutions from the threads of otherwise potentially disparate positions. As such, they strongly resemble the 'bricoleurs' theorised by Cleaver [21], as key agents in the bricolage of disparate but extant factors into practicable and constructive ways of working.

> *"You draw those other stakeholders in, in multiple different ways into the conversation . . . so that policy is something everyone feels they collectively own."*

However, this persona also has the potential to slow action down, as gaining and maintaining broad-based support is inherently time-consuming, and may even serve to underline the tensions between essentially agonistic positions [46].

> *"We can get bogged down in years of community consultation and dealing with objections. Each issue gets magnified and sucks more and more energy and time into that, rather than just doing it."*

4. Discussion

4.1. Using This Typology to Bring about Change

At an institutional level, we suggest that the performance of each of these personas is necessary within local government to drive rapid climate action, despite their potential to generate or amplify the barriers to action. By bringing these personas to presence, and paying attention to the different roles and functions they perform, we make them available to individuals and institutions to adopt, adapt and combine as conscious strategies to help achieve rapid climate action in the context of locally agreed plans and targets. They can be intentionally combined at institutional and individual levels in situation-specific ways, and used as a lens through which to understand and respond to the actions of colleagues and other stakeholders, and to relations within and external to the council.

> *"You need to take all of those approaches depending on who your audience is and the tailoring process that you need to adopt to really speak to them and to get across what it is that you need to do. I think it's incredibly useful to set out those different areas, those different approaches."*

> *"It certainly would help me to think, as a senior leader, about how I can influence people's thinking and behaviour and potentially use this as a way to help them understand how they're working and encourage them to think in different ways."*

This typology provides a conceptual framework to reflect on and deliberate both organisational strategy and personal effectiveness, responding to the imperative that "social science is arguably practiced best when it produces knowledge that the people being studied can themselves use to address better the problems they are experiencing" [47] (p. 15).

It also highlights the crucial, but often neglected and/or undervalued, role of the Weaver and its importance in generating ways forward, perhaps especially when 'nor-

mal' established processes are proving inadequate. All three of the other roles are readily conceptualised and so adopted by individuals in their working lives, likely with institutional approval. In goal-oriented organisations, and for goal-oriented, committed staff, however, the Weaver may often appear ineffectual in both the vision ('big picture') and the implementation ('brass tacks'). Yet, precisely as bricoleurs [21], they are in fact crucial in navigating institutions through moments of systemic crisis, when new thinking is needed and yet things must also carry on uninterrupted.

Using these personas in these ways—as a lens for understanding current thinking and behaviour, and as part of a deliberate strategy to achieve change—may assist individuals and institutions within local government to overcome some of the more tacit, oblique resistance to rapid climate action that persists internally and externally. None of the participants expressed opposition to acting on the climate agenda, and many noted that overt opposition was now rare, which in itself marks a significant and recent change.

> *"I think in terms of the wider public discourse we see less and less of people vocally being politically against action on these issues."*

Nevertheless, more tacit resistance, or brakes on change were described as widespread within the councils:

> *"I don't think it's all there, political buy-in . . . I can assure you a lot of the council officers I deal with on a daily basis have not bought into it."*

We have categorised these 'brakes', which appear to be motivated by the desire to protect other matters (rather than a resistance to climate action per se) into the following three different modes: direct, indirect, and attributed.

Direct brakes were understood as articulations that prioritising rapid climate action will necessarily be detrimental to other priorities, or that targets are unachievable.

> *"We will be carbon neutral by 2030. Well that ain't going to happen. We could be carbon neutral by 2030 but we'd also be bankrupt. But we might get 85% of the way, sensibly. So maybe 2040 or 2043 might be a more sensible guideline."*

Indirect brakes were understood as articulations that rapid climate action is not possible within established policy and procedures, that strategic ambition has not permeated down to operational processes, or that ambition does not take adequate account of the practicalities of implementation.

> *"The strategy says we're going to have a million trees or something like that, what does that actually mean? . . . there's no additional resource for any of that but there's just an expectation that we'll pick it all up."*

Attributed brakes were understood as articulations that change will be impeded by the actions or attitudes of others (publics, politicians, officers or businesses), which in itself generates resignation that change will be delayed or diminished.

> *"In spite of the great words of the vision, there's practical things on the doorstep . . . They see the big stuff but they act on the small stuff and the small stuff they act on is often contradictory to the big stuff."*

The cumulative effect of these brakes on change was summed up by one participant as follows:

> *"It's that non-decision making, or the quiet opposition, or the lack of active support, which I think is probably the undercurrent which is really stopping some of this from moving forward as quickly as it could."*

We thus offer these interpretations as a contribution to a phronetic approach to social science, both in that it draws on the participants' own phronetic understandings or practical wisdom about delivering rapid climate action, and in that it is intended as an intervention, the production of contextually specific knowledge that aims to enhance that phronetic understanding and help people act more effectively in particular situations. In both respects,

we highlight that the importance and existing practice of the four personas, including the crucial bricoleur role of the weaver, emerged immanently from our interviewees' own experience.

Using this typology of personas as a lens to think through how to address these brakes on change, and how to engage with the factors highlighted in Section 3.1, can provide a new perspective on the methods and tactics needed to deliver rapid climate action. For example, at an institutional level it could be used to map and develop competencies, aims and ways of working within and across departments, and to shape corporate and communication strategies on climate action; at a team or individual level it could be used to scope out the most appropriate ways of working to engage at different stages of a project and with different stakeholders, to identify gaps in capacity or adjust operational tactics.

One way of operationalizing these personas in considering either an individual or organizational strategy could be to characterise them in terms of their primary focus (i.e., whether they focus on what is to be done, or on how it is to be done) and their primary concern (i.e., developing policy/goals, or considering the implications of policy implementation). This classification can be presented as a matrix (Figure 1), which can be used to think through which arrangements and combinations of characteristics might be needed, or lacking, in a given situation.

		Primary concern	
		Goal/Direction	*Implementation*
Primary focus	*What*	Crusader	Pragmatist
	How	Entrepreneur	Weaver

Figure 1. Plotting primary concern against primary focus of typology personas.

This approach may be useful in helping to think through how to bridge the gaps between ambition and implementation, and between immediate actions and long term goals.

4.2. Bridging the Gaps: The Difficult Middle Ground

An extended quote from one participant on the process of making a climate emergency declaration and setting a net zero target helps to understand the gap between these ambitious, high-level statements and the everyday reality of local politicians and officials:

> *"That all happened in a number of weeks, going from right, we want to be really meaningful and radical in this and we've got political sign-up to work out what that looks like, to the external environment is requiring us to jump straight to a target that we have no idea how to get to, no evidence as to whether it's the right thing whatsoever, apart from a load of experts telling us that's what needs to happen if we're to take the climate emergency seriously. So while we've been on that path to get there, we probably wouldn't have got to 2030, we were pitching 2037 as radical, the politics overtook us and gave us that target."*

Taking the climate emergency seriously thus requires fundamental and previously unimaginable change, affecting every decision, across all service areas, internal operations and external procurement, as well as extensive stakeholder engagement to bring down local emissions outside of the council's control. This is a daunting prospect, which unsettles deeply sedimented and institutionalised common senses that specifically serve and enact existing concentrations of power. Despite the superficial recognition of the magnitude of change required, and considerable personal, professional and political commitment, its practical implications are not yet grasped and, perhaps more significantly, the path to understanding and engaging with these implications is very far from clear.

Several workshop participants likened the climate agenda to the equalities agenda, to emphasise an analogous need to mainstream and embed the climate agenda, or to propose an analogous method for doing so (e.g., to require climate impact assessments for all decisions). However, this analogy could also be taken as an illustration of the scale and nature of the challenge. Despite anti-discrimination laws dating back to the 1960s, and policies and mandatory procedures in national and local governments, such as equality impact assessments, very few people would argue that the equalities agenda has been satisfactorily addressed and that discrimination is no longer a problem. (We also note, with thanks to an anonymous referee, that such considerations could also be said to apply to the wide range of intersecting issues associated with, say, delivery of the sustainable development goals.)

Likewise, achieving the ambitious emissions reductions, to which local governments are committing themselves and their cities, will require more than plans, policies, technologies and targets. They will require an unprecedented cultural shift such that it is no longer acceptable (much less common sense) to view, for example, jobs or economic growth as a trade-off against emissions reductions. Rather, emissions reductions will have to become the lens through which other priorities can be achieved, they must be pursued together rather than set against each other. Generating such a shift, we suggest, requires the kind of phronetic approach that we have gestured to in this paper, and which this paper makes a small contribution to by exploring not just *what* challenges local politicians and officials face, but also *how* they engage with them in specific lived contexts.

This approach thus calls for both researchers and practitioners to 'dive into' the predicament and attempt to understand it from the inside, rather than simply seeking solutions that can be externally imposed upon it, drawing on both the explanatory, 'objective', realist registers associated with detached problem-solving, and the often-ignored performative, narrative, constructivist registers associated with a more interpretive understanding. The challenge is fundamentally one of ongoing, practical learning, not just about the objectively overdetermined external conditions of the climate crisis, but also about the subjectively indeterminate responses to crisis; this includes the interpretations of the crisis and how these are (or are not) integrated into the rich complexity of everyday lives. This involves the practice and incubation of a situated strategic–ethical wisdom—phronesis—at individual and thence collective and societal levels, in which this learning practice and orientation is both the means and end, practice of and capacity for, sustainable transition [48].

This kind of approach, guided by pragmatic choices and embedded in an ongoing iterative process of learning and doing, is necessary to bridge the gaps between ambition and implementation, and between the immediate and the long term. The participants in this study felt clear about the relatively small-scale, immediate actions that needed be taken, and clear in general terms about the end-state to be achieved (a net zero city), but the all-important medium term, leading from one to the other, is still an enigma, an unmapped and unknown territory. A phronetic approach will help both practitioners and researchers to navigate this difficult medium term through a process of ongoing learning. The path to delivering radical emission reductions may remain shrouded in fog, but the process of learning how to navigate the first steps of the path, enacting new narratives about climate action and its relations with existing responsibilities, priorities and lived experience, will in itself build a capacity for navigating later steps. Moreover, the need for such an approach will only be intensified by the aftermath of the more experientially immediate COVID-19 crisis, when councils will inevitably face budget cuts and pressure to retrench and focus on delivering core statutory services, and will face an external environment in which the following applies:

> *"Your external stakeholders who are basically saying, 'You are out of touch, you have no idea, I have no money in the bank, my business has closed and you're talking to me about carbon."*

A phronetic approach will thus be vital for local government in playing both a leadership and an implementation role in rapid climate action, and for future research to support them in this mission. How exactly to put it into practice in any particular context, however, is itself a matter of the situated phronetic judgement that the approach is trying to cultivate, and so it is all but impossible, by definition, to set out in advance. Hence, while at this stage when this shift in approach is still being presented anew, illustrative examples are hard to come by, our expectation is that attempts by local government stakeholders *themselves* to use the personas sketched out here as a framework for organisational, team or individual action would quickly develop a body of learning that would generate significant momentum, and especially where such lessons are shared across other local government institutions.

As researchers employing a phronetic approach, we feel that it is important to reflect on our own roles, our expectations of the research, and our reactions to the process and outcomes. A significant finding here was that, in conducting the interviews and workshops, we found it more difficult than we had anticipated to encourage participants to step away from their professional roles or 'corporate' positions. Initially, in our conversations with them, participants would stick to the official account of their organisation's performance. When prompted, some did reflect on their own roles, and started to talk through the difference between what they presented in public—the 'official line'—and their private uncertainties. We found that the workshop format, and particularly small group discussions and the creative visualization, helped to uncover these perspectives.

5. Conclusions and Implications for Policy

This research did not aim to develop detailed policy recommendations or prescriptions. However, our analysis points to some ways forward for the government at both a local and national level, which would help local decision-makers to implement rapid climate action.

First, it is important for the government, at both a national and local level, to acknowledge the rapid and far-reaching nature of the change that is needed. This allows a more open and honest debate about the 'implementation gap', and the fact that new ways of working will be necessary. An acknowledgement of the scale and nature of the issue frees up all parts of an organisation to respond to the challenge, and be upfront about the potential clash with existing procedures, priorities, policies and strategies. In practical terms, such acknowledgement would consist of a clear, unequivocal message from the national government about the need for rapid, co-ordinated climate action, led by all parts of the government.

Second, a common theme was the need for the national government to set a framework for local areas, making clear their responsibilities on climate, and resourcing them to respond, whilst leaving flexibility to allow local areas to develop their own responses. It is increasingly clear that some key levers (e.g., of fiscal or industrial policy) regarding the kind of profound change needed to address climate emergency reside squarely and solely in the hands of the nation-state. A wholesale agenda of the devolution of responsibility to local government could well thus do little to advance deep decarbonisation. Yet building the capacities of local government, and especially through and for ongoing phronetic learning, could have a doubly positive effect, enabling a new productive and cooperative division of responsibility for climate action between local and national government.

On the one hand, a more capable and empowered local government could increase and sustain pressure on the national government to use those essential but currently neglected levers that are uniquely at its disposal. On the other, though, the national government could be more willing to devolve other relevant powers to local government since this turns out to be a more effective way to deliver on national government priorities and manifesto promises, and crucially, without diminishing, but possibly enhancing, the power of the national (centralised) government. In short, a deeper engagement with a phronetic approach could empower local government to demand of the national government not that it hand over the reins, but, almost to the contrary, that it summons the political will to actually use the unique powers of the nation-state on this agenda *in parallel with* a greater

devolution of other responsibilities to the local level. This could, for example, take the form of a 'devolution deal' for climate, to provide a clear specification of the division of responsibilities between the national and local government.

Third, cities and other local areas should be prepared for the overall aim of responding to the climate emergency to conflict with existing procedures, referred to as the 'devil in the detail'. Local areas could create a mechanism that would allow local officers or politicians to flag such conflicts, and work through their implications and potential solutions, rather than—as is often the case currently—trying to work around them. In practice, this would mean local leaders making changes both to administrative procedures and to political priorities, to emphasise that climate action is a priority, and encourage teams to address conflicts rather than working around them.

Lastly, our study has highlighted the vital role played by local politicians and officials, using their own experience and understandings to develop and advocate ways forward. The participants in this project found that their involvement, and the opportunity that enabled them to reflect on the challenges and dilemmas they faced through the interviews and the city workshops, was helpful. This sort of support could be provided more widely, for example through training programmes, separate from existing systems of management or strategy development. Following the presentation of our findings to the local government officials, we have had enquiries about how it could be used in this way. This could help to develop working cultures which allow for a full and frank discussion about how best to respond to the climate emergency.

Author Contributions: Conceptualisation, methodology, writing, editing and project administration: A.Y., D.T. and R.W. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the UK's Economic and Social Research Council (ESRC) through the Place-Based Climate Action Network (P-CAN), grant number ES/S008381/1.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Lancaster University Faculty of Science and Technology Ethics Committee (protocol code FST19086, approved 20 February 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the participants to publish this paper.

Data Availability Statement: The data in this study consists of transcripts from interviews and workshops. These cannot be made available because of the ethics code agreed, and the need to assure anonymity for participants.

Acknowledgments: The authors would like to thank all those who took part in interviews and workshops, as well as Candice Howarth and Kate Lock from PCAN.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Intergovernmental Panel on Climate Change: Global Warming of 1.5 °C. Available online: http://www.ipcc.ch/report/sr15/ (accessed on 6 April 2019).
2. Climate Action Tracker: Paris Agreement Turning Point. Available online: https://climateactiontracker.org/documents/829/CAT_2020-12-01_Briefing_GlobalUpdate_Paris5Years_Dec2020.pdf (accessed on 13 February 2021).
3. United Nations Environment Programme: Emissions Gap Report 2020. Available online: http://www.unep.org/emissions-gap-report-2020 (accessed on 10 March 2021).
4. Hickel, J. *Less Is More: How Degrowth will Save the World*; William Heinemann: London, UK, 2020.
5. Kallis, G.; Paulson, S.; D'Alisa, G.; Demaria, F. *The Case for Degrowth*; Policy: Cambridge, UK, 2020.
6. Haites, E. Carbon taxes and greenhouse gas emissions trading systems: What have we learned? *Climate Policy* **2018**, *18*, 955–966. [CrossRef]
7. Fankhauser, S.; de Menezes, A.; Opacic, N. *UK Research on the Social Science of Climate Change: A Synthesis of ESRC and Related Investments*; Place-Based Climate Action Network; London School of Economics and Political Science: London, UK, 2019.

8. Rickards, L.; Wiseman, J.; Kashima, Y. Barriers to effective climate change mitigation: The case of senior government and business decision makers: Barriers to effective mitigation actions on climate change. *Wiley Interdiscip. Rev. Clim. Chang.* **2014**, *5*, 753–773. [CrossRef]
9. Willis, R. How Members of Parliament understand and respond to climate change. *Sociol. Rev.* **2018**, *66*, 475–491. [CrossRef]
10. Flyvbjerg, B.; Schram, S.; Landman, T. (Eds.) *Real Social Science: Applied Phronesis*; Cambridge University Press: Cambridge, UK, 2012.
11. Klein, N. *This Changes Everything: Capitalism vs. the Climate*; Penguin: London, UK, 2015.
12. Fazey, I.; Moug, P.; Allen, S.; Beckmann, K.; Blackwood, D.; Bonaventura, M.; Burnett, K.; Danson, M.; Falconer, R.; Gagnon, A.S.; et al. Transformation in a changing climate: A research agenda. *Clim. Dev.* **2017**. [CrossRef]
13. Fazey, I.; Schäpke, N.; Caniglia, G.; Hodgson, A.; Kendrick, I.; Lyon, C.; Page, G.; Patterson, J.; Riedy, C.; Strasser, T.; et al. Transforming knowledge systems for life on Earth: Visions of future systems and how to get there. *Energy Res. Soc. Sci.* **2020**, *70*, 101724. [CrossRef]
14. Willis, R. *Too Hot to Handle?: The Democratic Challenge of Climate Change*; Bristol University Press: Bristol, UK, 2020.
15. Bhaskar, R. *The Possibility of Naturalism*, 2nd ed.; Routledge: London, UK, 1998.
16. Bushe, G.R. Appreciative inquiry: Theory and critique. In *The Routledge Companion to Organizational Change*; Boje, D., Burnes, B., Hassard, J., Eds.; Routledge: Oxford, UK, 2012; pp. 87–103.
17. Schram, S.F.; Flyvbjerg, B.; Landman, T. Political Political Science: A Phronetic Approach. *New Political Sci. Stud. Politics Today Crit. Approaches Political Sci.* **2013**, *35*, 359–372. [CrossRef]
18. Flyvbjerg, B. Making social science matter. In *Social Science and Policy Challenges: Democracy, Values and Capacities*; Papanagnou, G., Ed.; UNESCO Publishing: Paris, France, 2011; pp. 25–56.
19. Tyfield, D.; Blok, A. Doing methodological cosmopolitanism in a mobile world. *Mobilities* **2016**, *11*, 629–641. [CrossRef]
20. Whaley, L.; Cleaver, F.; Mwathunga, E. Flesh and bones: Working with the grain to improve community management of water. *World Dev.* **2020**, *138*, 105286. [CrossRef]
21. Cleaver, F. *Development through Bricolage: Rethinking Institutions for Natural Resource Management*; Earthscan: London, UK, 2012.
22. Tyfield, D. *Liberalism 2.0 and the Rise of China: Global Crisis, Innovation and Urban Mobility*; Routledge: London, UK; New York, NY, USA, 2018.
23. Clark, N.; Szerszynski, B. *Planetary Social Thought: The Anthropocene Challenge to the Social Sciences*; Polity: Cambridge, UK, 2020.
24. Beck, U. *The Metamorphosis of the World*; Polity: Cambridge, UK, 2016.
25. Duara, P. *The Crisis of Global Modernity*; Cambridge University Press: Cambridge, UK, 2015.
26. Tsing, A. *The Mushroom at the End of the World*; Princeton University Press: Princeton, NJ, USA, 2015.
27. Haraway, D. *Staying with the Trouble: Making Kin in the Chthulucene*; Duke University Press: Durham, NC, USA, 2016.
28. Debray, R. *Prison Writings*; Allen Lane: London, UK, 1973.
29. Jessop, B. The symptomatolgy of crises: Reading crises and learning from them. Some critical realist reflections. *J. Crit. Realism* **2015**, *14*, 238–271. [CrossRef]
30. Riessman, C.K. *Narrative Methods for the Human Sciences*; Sage: London, UK, 2008.
31. Bernstein, S.; Hoffmann, M. The politics of decarbonization and the catalytic impact of subnational climate experiments. *Policy Sci.* **2018**, *51*, 189–211. [CrossRef] [PubMed]
32. Gillard, R.; Gouldson, A.; Paavola, J.; Van Alstine, J. Can national policy blockages accelerate the development of polycentric governance? Evidence from climate change policy in the United Kingdom. *Glob. Environ. Chang.* **2017**, *45*, 174–182. [CrossRef]
33. Warm, D. Local Government Collaboration for a New Decade: Risk, Trust, and Effectiveness. *State Local Gov. Rev.* **2011**, *43*, 60–65. [CrossRef]
34. Pitt, D.; Congreve, A. Collaborative approaches to local climate change and clean energy initiatives in the USA and England. *Local Environ.* **2017**, *22*, 1124–1141. [CrossRef]
35. Fünfgeld, H. Facilitating local climate change adaptation through transnational municipal networks. *Curr. Opin. Environ. Sustain.* **2015**, *12*, 67–73. [CrossRef]
36. Borah, P. Conceptual Issues in Framing Theory: A Systematic Examination of a Decade's Literature. *J. Commun.* **2011**, *61*, 246–263. [CrossRef]
37. Jennings, N.; Fecht, D.; De Matteis, S. Mapping the co-benefits of climate change action to issues of public concern in the UK: A narrative review. *Lancet Planet. Health* **2020**, *4*, e424–e433. [CrossRef]
38. Alina, H.; Dorothee, A.; Helen, F.; Rainer, S. Communicating the health co-benefits of climate change mitigation to households and policy makers. In *Research Handbook on Communicating Climate Change*; Homes, D.C., Ricardson, L.M., Eds.; Edward Elgar Publishing: Cheltenham, UK, 2020; pp. 279–290.
39. Jasanoff, S. *The Fifth Branch: Science Advisers as Policymakers*; Harvard University Press: Cambridge, MA, USA, 1990.
40. Morris, J.; Harrison, J.; Genovese, A.; Goucher, L.; Koh, S.C.L. Energy policy under austerity localism: What role for local authorities? *Local Gov. Stud.* **2017**, *43*, 882–902. [CrossRef]
41. Agnew, J.A. Space and Place. In *The SAGE Handbook of Geographical Knowledge*; Agnew, J.A., Livingstone, D.N., Eds.; SAGE: London, UK, 2011.
42. Borrowman, P.; Singh, R.; Bulleid, R. *The Local Climate Challenge*; Green Alliance: London, UK, 2021.

43. Climate Change Committee: Local Authorities and the Sixth Carbon Budget. Available online: https://www.theccc.org.uk/publication/local-authorities-and-the-sixth-carbon-budget/ (accessed on 11 March 2021).
44. Flyvbjerg, B.; Landman, T.; Schram, S. Introduction: New directions in social science. In *Real Social Science: Applied Phronesis*; Flyvbjerg, B., Schram, S., Landman, T., Eds.; Cambridge University Press: Cambridge, UK, 2012; pp. 1–12.
45. Lehman, J. A Brief Explanation of the Overton Window. Available online: https://www.mackinac.org/overtonwindow (accessed on 12 January 2021).
46. Mouffe, C. *On the Political*; Routledge: London, UK, 2005.
47. Schram, S. Phronetic social science: An idea whose time has come. In *Real Social Science: Applied Phronesis*; Flyvbjerg, B., Schram, S., Landman, T., Eds.; Cambridge University Press: Cambridge, UK, 2012; pp. 15–26.
48. Tyfield, D. Phronesis (and its potentially central contribution to mobilities research in the twenty-first century). In *Handbook of Research Methods and Applications for Mobilities*; Buscher, M., Freudendal-Pedersen, M., Kesselring, S., Grauslund Kristensen, N., Eds.; Edward Elgar Publishing: Cheltenham, UK; Northampton, MA, USA, 2020; pp. 345–353.

sustainability

MDPI

Article

Causes and Consequences of Local Government Efforts to Reduce Risk and Adapt to Extreme Weather Events: Municipal Organizational Robustness

Patricio Valdivieso [1,*], Pablo Neudorfer [1] and Krister P. Andersson [2]

[1] Faculty of Economic and Administrative Sciences, Universidad Austral de Chile (UACh), Valdivia 5090000, Chile; pablo.neudorfer@uach.cl
[2] Institute of Behavioral Science, University of Colorado, Boulder, CO 80303, USA; krister@colorado.edu
* Correspondence: pvaldivf@gmail.com or patricio.valdivieso@uach.cl

Abstract: This research article investigates the causes and consequences of municipal institutional arrangements for the provision of resilient critical infrastructure in municipalities. The study explains how the municipal organizational robustness and external institutional dynamics moderate the relation between capacities, leadership, and local government investment decisions. We examine hypotheses on moderating effects with regression methods, using data from 345 Chilean municipalities over a nine-year period, and analyzing the evidence with support of qualitative data. Our results reveal that municipal organizational robustness—operational rules, planning, managerial flexibility and integration, and accountability—is the most quantitatively outstanding moderating factor. The evidence leads us to deduce that efforts to support local governments in the emerging policy domain of resilient critical infrastructure require special attention to the robustness of municipal institutional arrangements. The results are valid for countries where the local governments have responsibilities to fulfill and their decisions have consequences for the adaptation. Since one of the objectives of the Special Issue "Bringing Governance Back Home—Lessons for Local Government Regarding Rapid Climate Action" is to explore how action is enabled or constrained by institutional relations in which the actors are embedded, this study contributes to achieving the goal.

Keywords: local governments; critical infrastructure investment; capacities; political leadership attributes; municipal organizational robustness; governance; Chile

Citation: Valdivieso, P.; Neudorfer, P.; Andersson, K.P. Causes and Consequences of Local Government Efforts to Reduce Risk and Adapt to Extreme Weather Events: Municipal Organizational Robustness. *Sustainability* **2021**, *13*, 7980. https://doi.org/10.3390/su13147980

Academic Editors: David Tyfield, Rebecca Willis and Andy Yuille

Received: 5 May 2021
Accepted: 7 July 2021
Published: 16 July 2021

1. Introduction

1.1. Research Question

Capacities and leadership are important ingredients of effective local government responses to frequent disasters and climate change [1–3], but how are the capacities and leadership translated into decisions and adaptation outcomes? To address this research question, this study investigated the causes and consequences of municipal institutional arrangements and governance relationships in shaping local government decisions to reduce risk and adapt to extreme weather events through investment in resilient critical infrastructure. The study contributes to new knowledge related to the organizational dynamics of disaster risk reduction (hereafter DRR) and adaptation in two ways. First, we draw on a broad literature to articulate a theoretically plausible set of hypothetical relationships between municipal institutional arrangements, governance relationships, and local governments investment decisions for critical infrastructure. While numerous previous studies have pointed out that local institutional arrangements are often important determinants of adaptation performance, and our previous work has helped identify several relevant factors [4], this research contributes more specific knowledge about *how* municipal organizational dynamics matter. Second, we used mixed research methods to assess these relationships empirically for a large number of local governments in Chile.

Critical infrastructure provides services that are essential to the normal functioning of a society [5,6], minimize the risks of multiple hazards, and reduce the impacts of climate change [7–11]. In high-income countries, the main emphasis for infrastructure is maintenance (hereafter Maintenance), whereas in low- and middle-income countries, the challenge is investment in building infrastructure (hereafter Investment) to cover basic needs [12–15].

Through decisions, local governments play an important role in DRR, mitigation, adaptation, and sustainable development in terms of Investment and Maintenance [3,13,16]. The local government decisions and outcomes are shaped by complex situations—biophysical, social, and institutional dynamics—that give rise to uncertainties, incentives, and opportunity costs [3,17,18].

1.2. Scope and Contributions

It is relevant to know more about the institutional causes and consequences of multiple efforts to reduce risk and adapt to extreme weather events. International frameworks, academic studies, and empirical evidence converge around the urgent need to increase efforts to improve critical infrastructure as a way to reduce vulnerability and improve coping capacities and resilience [3–9,12,13]. Local governments share the responsibility to provide resilient infrastructure [3,13]. However, improvement has been unhurried, especially in municipalities of low- and middle-income countries, where an important part of the population live at risk due to deficits on critical infrastructure [13]. Therefore, we are in need of knowledge to understand the breach between infrastructure needs and local government decisions.

Conceptual reasons suggest that the gap between demand and supply will persist where institutional conditions and constraints negatively affect local government performance [17–28]. Hence, further research and evidence-based knowledge are required to understand how municipal institutional arrangements shape public infrastructure outcomes, and how improvements may trigger local government performance. Despite growing interest in critical infrastructure [6,9–12,14,15], there is still insufficient empirical evidence about how municipal institutional arrangements and governance processes shape local governments' outcomes [3,13]. The conventional literature on infrastructure approaches the subject mainly from a technical–economic perspective [9–11,14,29–33]. The literature on sustainable development, DRR, climate change mitigation, and adaptation in cities and municipalities (hereafter sustainable cities literature) has integrated research frameworks and theories on organizational behaviors and governance relationships [1–4,13,34,35]. Some studies analyze experiences or compare cases of local governments that often are already committed to a transition [1–3,34–36]. However, more attention should be given to institutional dynamics (e.g., municipal institutional arrangements and governance processes) shaping decisions and outcomes in typical local governments (committed or not to address climate change or natural DRR), particularly in low- and middle-income countries.

One of the clear conclusions of the previous literature is the role of leadership. However, the issue of leadership is not really addressed sufficiently. Acknowledging this weakness in the literature, the exhaustive review by the Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change states that there is less research on local government decisions to include adaptation in plans and investment programs [13]. Our study with Chilean municipalities contributes to fill this gap enhancing the understanding of how municipal capacities and some political qualities that increase the effectiveness of the mayoral leadership are translated into institutional decisions. The analysis produces evidence in relation to how variables that represent municipal institutional arrangements and governance processes moderate the effects of variables that represent capacities and political leadership attributes in local government decisions regarding Investment. Through this result, we know that the municipal organization robustness is what explains how the capacities and motivation of leaders lead to concrete local government decisions in terms of adaptation. A robust municipal organization involves a consistent

set of norms, operational rules, units, positions, and programs, guided by the explicitly stated organizational goals related to critical infrastructure. The coordination mechanism between departments, planning, integration, accountability, and transparency (e.g., responsibility, liability, access to accurate information) ensure local government decisions based on effective communication and congruent behavior by all its members.

Since no full-blown theory of local government decisions existed until now, the literature on the subject proposes a varied set of possible institutional drivers affecting local government decisions [3]. We focused our research on understanding how municipal institutional arrangements and governance processes interact with both capacities of local governments and political qualities of the mayoral leadership (hereafter political leadership attributes). Capacities and political leadership attributes that support motivation have been identified by one part of the sustainable cities literature as key factors in shaping outcomes [1–4,13,35–38]. Hence, we start from the assumption that in order for municipalities to be effective adaptors in terms of critical infrastructure Investment, they need to be organizations with resources (capacities) and have highly motivated agents with political leadership attributes (e.g., networks, support, continuity). If they do not have these qualities, the likelihood that they will be effective decreases [1,2,13].

Theories on institutions, organizational behaviors, and governance relationships appeared to be a suitable way to explore the Chilean experience with regard to how capacities and leadership are translated into institutional decisions and outcomes. The institutional dimension can be broadly divided into internal processes related to issues of municipal organization, on one hand, and interactive external dynamics of governance on the other [3].

Therefore, we sought to understand if and how municipal organizational arrangements and governance relationships moderate the connection between capacities, political leadership attributes, and local government Investment in almost all typical Chilean municipalities (345 out of 346). We examined the validity of the conjecture on moderation effects with regression methods and interactions, using longitudinal data for almost all Chilean municipalities over a nine-year period, analyzing the findings with the support of qualitative evidence. Despite our focus on moderation effects, we are aware of the challenge of measuring causality with the observed data and interactions between variables. We face the challenge with the control function, the treatment of variables, and describing relationships in conditional rather than general terms [39,40]. To give order and direction to our exploration, we proposed the following ex ante hypotheses:

Null Hypothesis 1: The effects of capacities on Investment (Maintenance) are direct and independent. Capacities consist of resources available within the municipality and include financial, human, and professional expertise [1–3,13,35,38]. Hence, regardless of institutional moderators, capacities are always the key factor for Investment. Alternative 1: The relationship between capacities and Investment (Maintenance) depends on the interactions with municipal organizational arrangements or governance relationships.

Null Hypothesis 2: The effect of political leadership attributes on Investment is not affected by municipal or external institutional dynamics. The effect of political leadership attributes of the mayors and/or senior staff in their own right are documented by a large number of sustainable cities studies [1–3,37]. Some attributes that enable actions of leaders are agency and power in terms of electoral, political, and institutional support, and continuity [3,4,36,37]. Alternative 2: Municipal organizational arrangements or governance relationships affect the direction and strength of the relation between leadership and outcomes.

We tested Alternative Hypotheses 1 and 2 guided by a growing case-based literature on organizational behaviors suggesting that capacities and leadership have conditional effects [3,4,34–36,41–44].

Our results reveal, on one hand, that the observed heterogeneity in Investment and Maintenance decisions at the local government level in Chile is associated with both capacities and political leadership attributes, leadership being the most quantitatively

outstanding ingredient. On the other hand, the evidence also shows that municipal organizational arrangements such as operational rules, accountability, planning, interdepartmental coordination, and municipal integration moderate the effects of both capacities and political leadership attributes in Investment. Even though governance relationships have moderation effects, the results reveal that internal organizational arrangements are more quantitatively relevant. The evidence leads us to deduce that efforts to support local governments in the emerging policy domain of resilient critical infrastructure require special attention to the robustness of the municipal organization.

The study is structured as follows. First, Background (Section 2) explains why Chile is a suitable case to explore relationships between municipal organizational arrangements and governance dynamics driving local government to advance in Investment. Literature Review (Section 3) summarizes and analyzes theories and evidence from studies. Modeling Moderating Effects (Section 4) presents the approach we implemented to analyze moderation effects. Methodological Design (Section 5) explains the steps of research. Results (Section 6) contains the evidence and our analysis with the support of qualitative evidence. The conclusions summarize the implications that emerge from the analysis.

2. Background: Chilean Case

Chile is a suitable case to analyze the institutional causes and consequences of local efforts to adapt (Figure 1). The country is a unitary republic with national ministries, 16 regions, and 346 municipalities [3,45–49] (Figures A1–A3 in Appendix D). The municipalities have mandates, budgetary autonomy, and staff to design and execute local development plans, under the leadership of elected mayors and municipal councils [50]. Most of the municipal territories require Investment [4,51–54]. The period 2009–2016 is particularly interesting to explore, because it was a time of transition from an extremely centralized state toward greater autonomy at the subnational level [51,55].

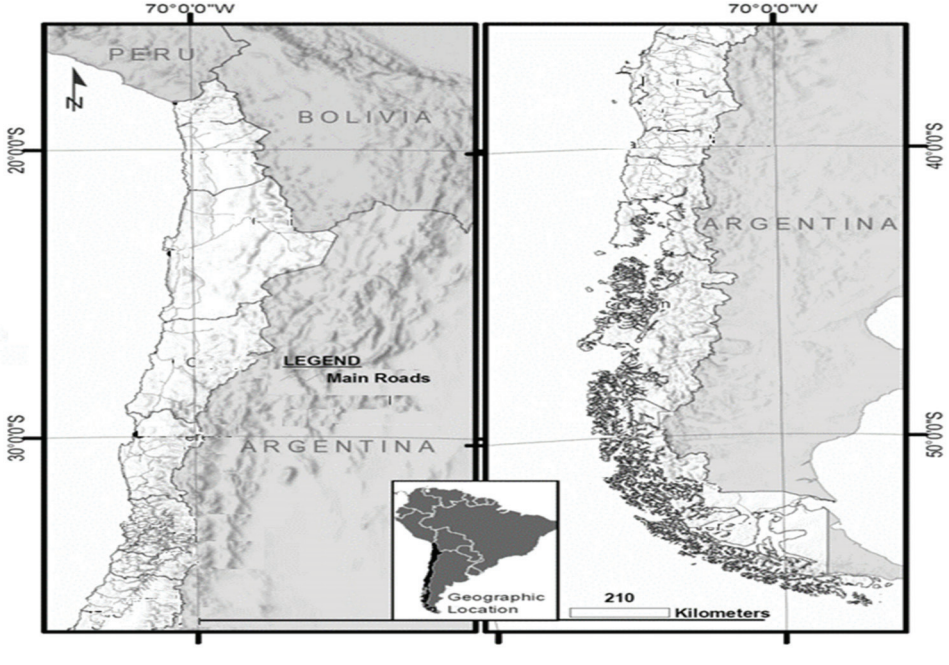


Figure 1. Chile in South America, northern part on left and southern part on right [45,46,56,57].

Traditionally, Chilean municipalities fulfilled functions of providing very basic services, such as cleaning, garbage collection, and maintaining public goods [51]. Since the mid-2000s, a set of national policies prescribed more functions and powers for local governments with the expectation of proactive provision of public goods and Investment [3,49–51,55,58]. At the same time, increasing awareness regarding the environmental conditions motivated transitional national policies on adaptation [54,55,59–83].

Almost all Chilean local governments had the same possibilities to advance proactively in the emerging policy sphere of DRR, climate change adaptation, and Investment, but there were striking contrasts in how local governments progressed [47,51–55,60–62,82,83].

The only existing survey of 98 representative municipalities in nine regions, where 90% of the country's population lives, directed at municipal senior officials, reveals a high degree of variability in the goals of climate change adaptation and planning, DRR, and engagement with Investment, which motivates questions regarding evident inconsistencies [56]. On one hand, manifesting a high degree of recognition of climate change, 95% of the interviewed officials reported they really believe climate is changing and more negative events will be produced by the change; 84% said that the mayors champion policies, planning, and actions to move forward into climate change adaptation. On the other hand, 42% reported the issue was a priority for the local government, and only 37% said that municipal staff officials agreed with those goals. Asked if the local government engages with Investment for DRR and climate change adaptation, 78% provided information about prevention routines to reduce damages caused by emergency situations, and only 38% said actions are taken toward Investment in terms of DRR, mitigation, or climate change adaptation [5–8,12,13,84,85]. Only 37% agreed that their municipalities are prepared to face climate change.

3. Literature Review

Much of the current literature on public infrastructure discusses needs and options for resilience of critical infrastructure [6–9,12,14,15,29–33,85], but overlooks the institutional reasons for variability in local government performance [1–3,16,86–88]. One part of the available literature on sustainable cities addresses institutional contexts that shape local government decisions [1–3,5,13,18,23,34–37,41–44,88–90]. However, until now, we have known far too little about how those dynamics explain critical infrastructure investments in typical municipalities, like in Chile.

Because there is not a full-blown theory connecting explanatory components with local government outcomes [3,17], we assume that several institutional factors may influence local government decisions, for example capacities, governance, leadership, and political factors, among others [3–5,91]. To focus on hypotheses about institutional moderators, we selected capacities and political leadership attributes as factors that may have direct and independent effects on local government investment decisions, on one hand, and municipal organization arrangements and governance relationships as potential moderators on the other. The review of literature seeks to understand how the selected institutional factors and processes may affect local government decisions and outcomes.

3.1. Capacities

In the sustainable cities literature, budgetary resources, workers, and skills are essential for effective DRR and adaptation [1–3,13,38,89–95]. One assessment in the review by the Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change states that financial capacities provide a foundation for city resilience on which adaptation can be built [13]. Still, local government performance also depends on participation, commitments, will, and institutional plans toward goals [3,35,41,55,96,97].

Human resources with regard to staff, work time, managerial, and staff competences seem to be another relevant dimension of capacity [1–3,13,34,90–98]. The emerging policy spheres of adaptation planning, investment, and implementation of new resilient infrastructure, for example, require permanent staff with technical understanding [29,92,94,98].

Staff, however, may have commitments to managerial routines, rejecting adaptation if perceived to have no valued benefits [1,2,18,36,44,89–100].

In terms of cognitive capacity, procedural and enabling skills facilitate the mobilization of resources to reach specific goals [101]; for example, trained professionals can frame issues and use skills to apply methods. The literature on sustainable cities exhibits evidence of the relevance of knowledge and skills for planning [1–3,23,29,93].

3.2. Leadership

An increasing number of studies address the role of agents, ideas, and agendas in organizations and political processes [1–3,36,37]. In contexts where new policy spheres for action are emerging, leadership has become conceptualized as the driver of organizational behavior [2,102–104]. Nevertheless, leaders need opportunities, supportive networks, and conducive political contexts to advance in their agendas [3–13,34–36,42,105–112].

In municipal organizations, leaders are frequently elected officials or senior managers. For example, historically, city mayors have played an important role in the USA [103]. The literature of sustainable cities has highlighted the importance of leadership for DRR and adaptation, reporting actions of individuals [2,3,113,114]. Nevertheless, in typical local governments, mayors and senior officials also may obstruct initiatives, depending on how they and/or their supportive networks understand the issues and incentives [36,55].

Leaders may be motivated by several processes and mechanisms such as organizational incentives, changes in the intellectual climate of ideas, and systemic interactions [35,44,115,116]. In democratic systems, the behaviors of leaders are linked to sources of support [41,103,117]. Factors such as electoral motivation and continuity influence decisions and outcomes [109,118].

In the municipalities, mayors or senior officials may use strategies rationally to advance goals [2,89,103]. However, municipal leaders need the support of municipal councils, staff, constituents, stakeholders in society, and regional and national governments [2–4,18,25,34–36,42,54,90–92,94,98–101,103,108,110,119].

3.3. Municipal Organization

Sociopolitical outcomes are driven in part by political institutions, for example, electoral systems and encoded prescription [41,44,86,109,120–122].

One part of the institutionalist literature conceptualizes organizations as institutionalized social norms that are sources of stability and order [41,120–124], i.e., resilient encoded prescriptions, operational rules, and restrictive organizational templates [87,124]. As structure, organizations consist of units, positions, and programs linked by explicit goals. These components explain shared institutional logics and patterns of relationships.

Another part of the literature highlights that individual behavior of utility-maximizers drive decisions in organizations [99,120,125–127]. Organizational behavior is the consequence of the interlocking choices by maximizer individuals and subunits, each acting in terms of expectations, preferences, and rational choices. However, since individual behavior in organizations is embedded within prevailing organizational logics, the free play of individual will and calculation have restrictions.

Public organizations and staff tend to reproduce routines, with little room for innovations [128]. According to Tullock [99], staff professionals are inclined to be reluctant to change because they want to minimize risks. Since security is defined as maintenance of routines, achieving many objectives simultaneously (e.g., income, position), according to Downs [22], staff professionals prefer the status quo and fear change.

Organizational hierarchy and compartmentalized functions hinder functional efficiency. To overcome the challenge and increase robustness (the property of being strong to achieve organizational goals), Downs [22] proposes that all organizations should institutionalize some kind of coordination mechanism and procedures. These ideas are close to what is understood in sustainable cities literature as robust institutional arrangements,

accountability, and transparency [3,13,129–131]. Robust organizational arrangements may enrich governance outcomes [13].

The theories of organizational dynamics shed light to understand trajectories and compare local government experiences regarding DRR, climate politics, and adaptation planning. Sustainable cities scholars have made great strides in showing how internal organizational contexts affect adaptation planning [2,3,5,18,23,35,36,55,89,90,101,114,132,133]. For example, operational rules combined with competing development considerations may limit municipal agendas [1,2]. Municipal organization in terms of council–manager and mayor–council may have effects on municipal outcomes [133]; councilors prioritize issues depending on their agendas [55].

The literature of sustainable cities shares a consensus around the benefits of planning to advance in adaptation [1–3,13,34–36,90,96,97,100,133,134]. In some cases, DRR or adaptation planning in specialized units increases coordination, integration, and consistency in organizational structure [96,133].

3.4. External Institutional Dynamics and Governance Relationships

Positivist legal theories identify the state as a legal order with binding authority over all actions taking place within its area of jurisdiction [135] but norms are interpretable and applied by agents [17,123,124,136].

Structural functionalist approaches shed light on systemic dynamics shaping outcomes such as interactions between the institutional environments and organizations [119,121,122,124,137]. Organizations are conceptualized as parts of a larger system, subsystems with multiple overlapping connections [17,87,121,137]. Stimuli, reactions, and feedback processes induce resilient maintenance, adaptation, or change [119,122,124,137–141].

In game theory frameworks, a variety of interactive dynamics between goals, strategies, structures, roles, and rational choices make players in each game use other players for their purposes [17,87,142]. Through these processes, diffusion and cooperation may occur, producing functional results [143,144]. Therefore, macro- and middle-level action arenas, such as national and regional, and decisions on policies and plans may affect contexts and behaviors of local governments.

Recognizing this type of dynamic, scholars from several disciplines converge around the concepts of multilevel governance as explanans of outcomes [3,17,43,145,146]. The literature on sustainable cities reports on external dynamics, incentives, and interactions influencing local governments' decisions [1,3,13,42,43,147–152]. For example, national and subnational policies of climate change adaptation [1–3,13,100,115,117,132], international regimes [3,4], agencies, and several networks championing mitigation and adaptation [1–3,42].

Until now, theories and scholarly contributions linking integration, network, and governance relationships have exercised a strong influence on the research agenda and public policies for sustainable cities [3,5,12–14,42,43,85]. Hence, the external institutional dynamics and governance relationships may have moderating effects on the relationships between capacities, leadership, and local government decisions.

4. Modeling Moderating Effects

Situating the analysis in the Chilean context, where there is an urgent need for more resilient infrastructure [51–53,60], we assume that Investment is desirable. Hence, the analysis seeks to understand how the capacities and political leadership attributes in the Chilean municipalities translated into local government decisions in Investment. In this section, we display the model specification for the analysis.

4.1. Considering That Several Local Governments Do Not Invest in New Projects

The dependent variables under analysis are Investment (in new infrastructure) and Maintenance (of current infrastructure). The data of our sample of 345 municipalities show that all local governments in Chile invest in Maintenance [82] (Table A2 in Appendix B),

which is easier and cheaper than investing in new infrastructure (i.e., Investment). Several local governments do not invest in new projects at all. As discussed (e.g., Null hipotheses, Literature Review), the drivers of the low or null investment are arguably driven by low municipal capacities (financial, human) and/or weak political leadership attributes.

Since several local governments do not invest, the variable Investment is nonlinear (e.g., local governments with zero Investment). This situation is referred to as a corner solution and the standard linear model is not the best methodological approach in this setting [153]. Hence, we implemented a Tobit regression model specifying that the investment variable is limited from the left at zero. Formally, the expected value of the annual investment per inhabitant at t in municipality i is defined as

$$E(y_{it}|X\beta) = \Pr(y_{it} > 0|X\beta) * E(y_{it}|X\beta, y_{it} > 0) \quad (1)$$

Equation (1) assumes that the expected investment among municipalities and across time, y_{it}, depends nonlinearly on a vector of variables X and a vector of parameters β. The nonlinearity arises when we observe that for some municipalities and some time periods, $\Pr(y_{it} > 0|X\beta) = 0$, which is the source of the observed null investment for some local governments.

4.2. The Moderating Effect of Municipal Organization Arrangements and Governance Relationships

According to the Alternative Hypotheses and literature review, effects of capacities and political leadership attributes may be part of a configuration of factors moderated by municipal organization arrangements and governance relationships (hereafter institutional dynamics). Assuming that moderation arises where the association linking the independent and dependent variables is conditional on other variables, moderating effects are specified as multiplicative terms (e.g., interaction) [39,40,154]. To gain insight into how the conditioning effect works, we present the following illustrative standard linear model, Equation (2):

$$y_{it} = \alpha + \beta_1 x_{it1} + \beta_2 x_{it2} + \beta_3 x_{it3} + \beta_4 x_{it1} x_{it3} + Controls + \gamma_t + \gamma_i + \varepsilon_{it} \quad (2)$$

Equation (2) defines that the output variable is driven by x_{it1} (e.g., capacity variables), x_{it2} (e.g., political leadership attribute variables), and x_{it3} (e.g., institutional dynamics). The last variable plays a double role: a direct effect, and a moderating effect between x_{it1} and x_{it2} and y_{it}. In our setting, the direct effect is seen as a control to concentrate on the moderating effect. We assumed that the error term, ε_{it}, is a zero mean independent and an identically distributed random component. Particularly, we assumed that, conditional on all included control variables, ε_{it} is independent of x_{it1}, x_{it2}, and x_{it3}.

5. Methodological Design

The main goal of this research study was to produce findings related to the expected moderation effects of institutional dynamics. We designed procedures to test hypotheses about how municipal organization arrangements and governance relationships may affect investment decisions in critical infrastructure and maintenance. Next, we summarize the methods used with their respective advantages and limitations.

5.1. Quantitative Analysis: Case Selection Variable, and Data Analysis

5.1.1. Case Selection

To explore evidence around the Alternative Hypotheses on moderating effects of institutional dynamics (i.e., municipal organization arrangements and governance relationships), we included in the analysis almost all Chilean municipalities (345 out of 346). All of the subnational territories and communities are affected by deterioration of environmental conditions, frequent disasters, and climate change and require more investments in resilient critical infrastructure [45,47,51–55,57,59–83,155–176].

5.1.2. Variables

We evaluated a wide set of potential dependent, independent, and moderation variables considering the availability of data and selected those that best fit the research question and hypotheses of our study (variables described and justified below). We carefully selected metrics that best fit the concepts of the hypotheses, collecting reliable data from several public sources with available information (e.g., national, regional, and municipal), and by request (Figures 2–5).

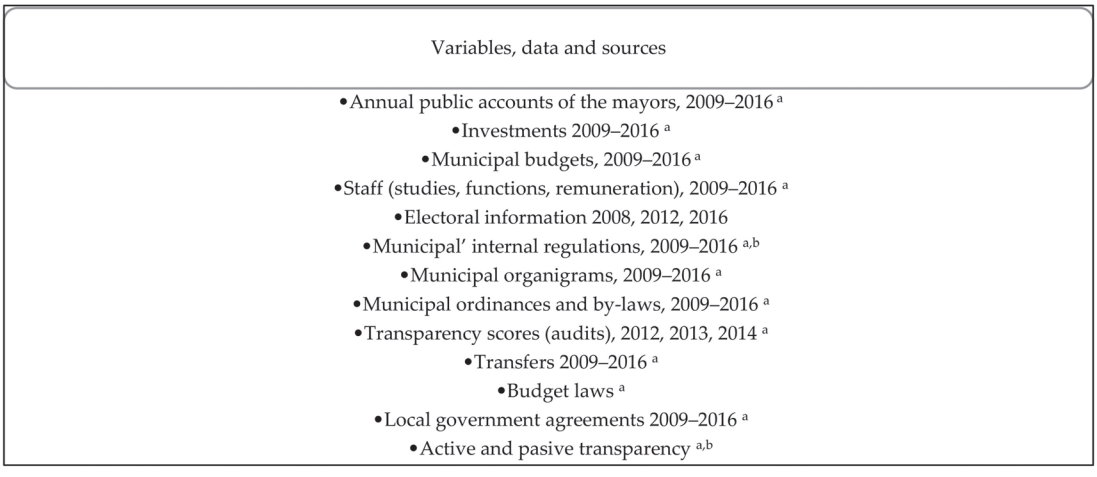


Figure 2. Explanans and explanandum variables, data and sources. [a] Municipal secretaries, planning offices, websites, and by request (Figures 2–5, data source [82,177–180]). [b] Requests for Transparency for the following pieces of information, from 345 municipalities: (1) questionnaire with 25 questions regarding consulting information on categories included in the Municipal Organization Index, with 260 written responses (via Municipal Secretary and Transparency Office) and a chronological record of submissions and responses, December 2015 to April 2016; (2) requests to complete information not available on municipal websites or other sources of information (e.g., years of annual accounts, minutes of municipal councils, budgets), with chronological record of submissions and responses April 2014 to December 2020.

We are aware of possible limitations of the availability of data and selected variables for the quantitative analysis. For instance, the fact that local governments with motivated mayors enjoying electoral support are more adaptive in terms of critical infrastructure investment is shown in the data, but this may be due to factors that we could not observe with our data. Due to data constraints, we could not consider in the analysis all possible factors that the previous literature of cases suggests are relevant for adaptation, for example, business needs, framing, or social trust [4]. We faced this issue using a rich set of controls at municipal level (data sources, Figure 3).

Investment and Maintenance. In Chile, local governments have some responsibilities that are shared with other organizations [51]. For example, investments in education, health, and security are determined by the ministries, and the municipalities collaborate in local planning and implementation. The same happens with housing subsidies, which are not in the domain of local government investment decisions. Therefore, the study focused only on investments that depend on local government decisions, which, according to the results of official surveys applied during the study period, were demanded by the citizens. We used Investment and Maintenance as dependent variables [82]. During 2009–2016, new critical infrastructure were designed to cover citizens' needs and development goals, complying with national standards (e.g., DRR, adaptation, and environmental protection) [6,12,60–62,82]. The projects were designed by the municipalities (study, preinvestment, project design, and execution), and the local governments financed the costs with their own resources and by applying for funds at national and regional levels [82].

The designs were very time-consuming and expensive and required specialized studies and evaluation stages. Maintenance projects cost less for preparation in terms of financial resources, personnel, and studies, and the approval was faster [4,82].

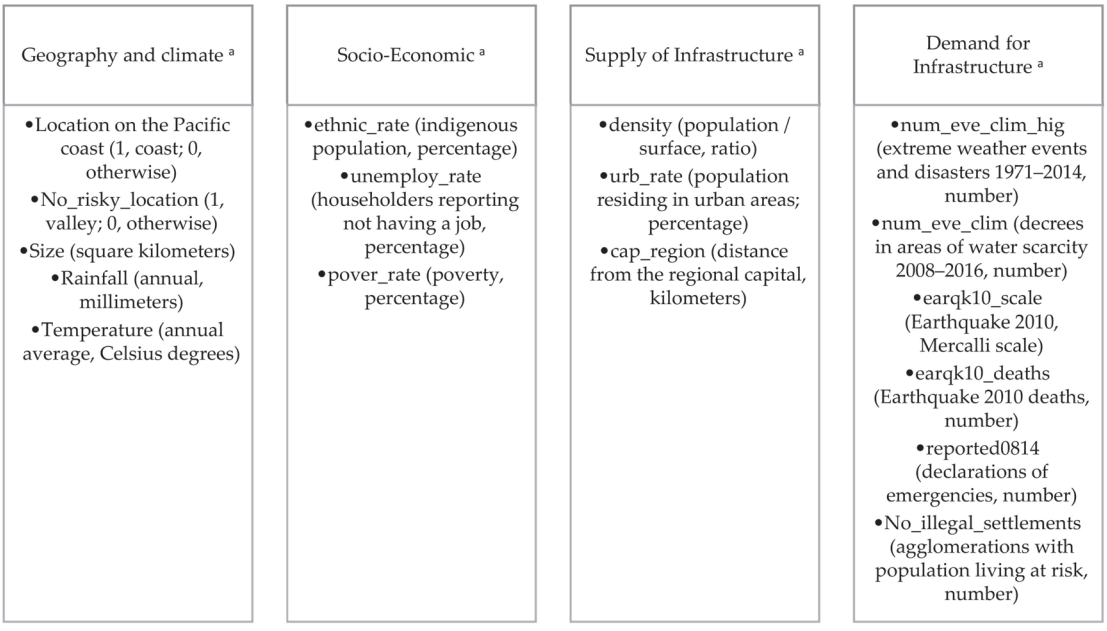


Figure 3. Control variables, data and sources. [a] Reliable data from several public sources with available information [47,48,53,57,63,68,73,76,79,85,167,168,170–172,175,181].

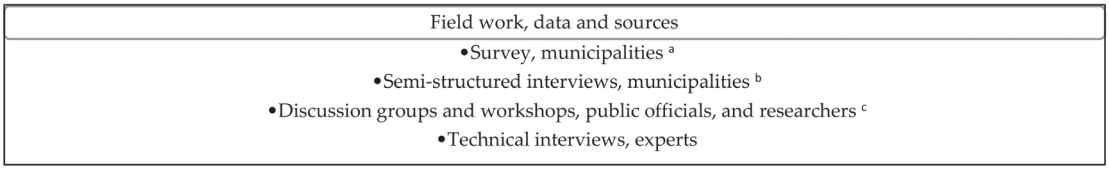


Figure 4. Interviews. [a] Face-to-face survey with semi-structured questionnaire conducted by the contracted professional Group Demoscopica with 159 senior functionaries of 79 municipalities in nine regions (directors of environment, civil protection and emergencies, planning, public works, and social organizations), between April 2015 and March 2016, and conducted by research staff of the Project FONDECYT with 45 senior functionaries in 19 municipalities between April 2015 and December 2016 [56]. [b] Senior officials, five in each municipality (average). Chronological record of interviews: March to June 2014, October 2014 to October 2018. [c] Discussion groups organized with representatives of national, regional, and municipal offices, academic seminars, and workshops with a chronological record April 2014 to April 2021 [56].

For the selection of dependent variables—Investment (in new critical infrastructure) and Maintenance (on existing infrastructure)—we considered the information we had on the Chilean context (see Background: Chilean case; interviews, Figures 1 and 4, Figures A1–A4), particularly evaluations made by ministries and international organizations of the need for critical infrastructure investment in the municipal territories [51,59,60,62]. Regarding the quality of our data, we are convinced that the measures for the two dependent variables that we used in the analyses are both accurate and reliable. We made this assessment based on two factors: (1) These are official data that are used by the government to make public funding

allocations, and as such the data and the process that generates them undergo repeated internal checks and controls (e.g., audit process associated with the production of these data) by the Budget Directorate of the Ministry of Finance and the Office of the General Comptroller of the Republic. (2) Our classification of the data in two separate categories for the creation of our two dependent variables was informed by personal interviews with representatives of national, regional, and municipal officials and experts (Figure 4). We consulted these authorities to be sure that our classification was accurate. For these reasons, we are confident that our dependent variables data reflect real local investments in these categories.

In relation to the independent and moderation variables, we considered a wide set of potential variables and availability of data. We carefully selected as variables those metrics that best manifest the concepts of the hypotheses, collecting reliable data from several public sources with available information (e.g., international, national, regional, and municipal), and by request (see data sources in Figures 2 and 5). For example, for national resource transfers, we considered transfers intended to improve resilient infrastructure, i.e., special funds for roads, sanitation infrastructure, development of local initiatives, and neighborhood improvement funds. While these funds aim to support municipalities' efforts toward new investments, local governments decide autonomously whether or not to invest in such areas. The procedure consisted of (1) a review of expenditure items in national budgets to identify such funds and (2) a review of annual budgets of ministries and regional governments in the national databases administered by the Ministry of Finance to identify all transfers made in the period 2009–2016. Next, we describe the variables (see descriptive statistics in Tables A1 and A2, Appendices A and B).

Municipal capacities. We included the variable "partFCM": proportion of the total municipal budget from the Municipal Common Fund (MCF, or FCM in Spanish) [32], which is a redistributive scheme in Chile [34] (see data source Figure 2). The variable reflects long-term relative budgetary deprivation, which in turn identifies municipalities historically less developed [48]. Since Chile had consistent growth during 2009–2016 [182], we expected municipalities with few infrastructure measures to have a high MCF and to invest relatively more in new projects compared to Maintenance because they do not have much infrastructure to maintain [51].

We included the following conditional exogenous variables as proxies of human capacities (e.g., the variables are independent on the error terms once controls are included in the regression): (1) proportion of employees working in the environmental field, (2) proportion of employees working on civil protection and emergencies, (3) proportion of employees holding a bachelor's degree (measures staff professionalization), and (4) mayor's education level (see data sources in Figure 2). More intense human capital may be associated with higher levels of Investment [1–3].

Leadership, political viability/support. Considering the Chilean context (e.g., lack of critical infrastructure, climatic change, frequent disasters, citizen needs, constitutional norms, national policies, centralized governance) and interviews in municipalities [3,48,49] (Figures 2 and 4), we presumed the mayors should be motivated by Investment in resilient critical infrastructure. Hence, regarding viability, we selected the following variables as proxies of qualities that may enable actions of the mayors [2,3,35,36,102,103,109,118,177]: (1) the proportion of the mayor's winning votes reveals electoral support and commitment to citizens' needs, (2) the proportion of members of the municipal council in the same political coalition as the mayor represents support, (3) the mayor's belonging to the ruling party indicates political support, and (4) the mayor being in a second term indicates continuity (e.g., experience), (see data sources in Figure 3). High levels of political leadership attributes may be associated with higher levels of Investment.

Municipal organization. We used three variables to measure municipal organizational robustness. First, autonomy of the municipal council is a rate index based on reading and coding available council regulations using a binary criteria (0,1), recoded into three categories for the regression analysis (high, medium, low) (see data sources in Figure 2). It

includes prescriptions of accountability (specialized commissions, hearings and audits, free access to information about municipal actions, and free expression in council meetings). Second, a rate index is based on available prescriptions of municipal internal organization using a binary criteria (0,1), also recoded as high, medium, and low (see data sources in Figure 2). This variable quantifies information on institutionalized planning, operational rules of management (e.g., performance agreements, incentives, evaluations), coordination, and integration (e.g., land planning, DRR, adaptation, environment, infrastructure). Third, compliance with standards of transparency consists of data on municipal compliance with normative prescriptions [178]. Accountable municipal councils, robustness of municipal organization, and transparency may enhance the effects of variables representing capacities and political leadership attributes on Investment [3,16,22,55,129–131,183,184].

Resource transfers. In Chile, financial transfers from national to local governments represent institutional incentives created by governance relationships [3,51,58,180]. During the period 2009–2016, the sampled municipalities received monetary funds from ministries [48,179,185] (see data sources in Figure 2). The transfer variables to improve urban infrastructure equipment measure annual per capita monetary transfers from the Undersecretary of Ministry of Interior and Public Safety (SUBDERE) aimed at improving local infrastructure [186,187]. We expected moderating effects of those transfers on the relationships between capacities, leadership, and local government decisions [1,3,6,12–14,43,100,105,132,133,145–148,188].

Control variables. The control variables measure attributes of location, climate, population, socioeconomic fragilities and deprivation in infrastructure, extreme weather events and disasters, and financial and territorial administration [45,47,48,57,68,69,73,75,76,79,80,169,171–174]. We followed the control function approach to alleviate endogeneity concerns [40]. All random effect Tobit regressions included a rich set of 17 mutually uncorrelated exogeneous controls at municipal level along with time dummies at the year level, regional dummies, and capital city dummies (see description of variables in Figure 3). In this study, the control variables captured unobserved heterogeneity that might be associated with some of our target variables (endogeneity).

5.1.3. Data Collection and Analysis

The data collection and analysis consisted of the following seps: first, model specification, operationalization of concepts, and selection of metrics to explore evidence around hypotheses; second, data collection in official sources with available information and by request; third, population of databases, normalization of variables, recoding, and observation of central tendency measures; fourth, application of criteria for variable selection, i.e., accuracy of available data, validation by academic workshops, and consults with experts [56] (see data sources in Figures 2 and 5); fifth, we controlled for time and spatial effects along with other variables to provide a consistent estimation of conditional effects [39,40]; sixth, when defining the set of controls, we checked for imperfect multicollinearity and selected those with a large amount of independent variance; seventh, programming in STATA No. 16 using XTTobit command according to the model specification and expert-recommended procedures [189] (see xttobit command syntaxis in Appendix C); eighth, the standard errors of marginal effects were computed using the Delta method [153,190]; ninth, analysis of the regression model coefficients interpreting marginal changes in the dependent and independent variables, taking into consideration the fitness of the models; and tenth, selection of standard deviation and median as metrics to compare and discuss the results [191,192].

Figure 5. Illustrative cases, context. [a] Reliable data from public sources with available information [45–48,52,53,56,63,66,68–70,73–76,79–83,167–179,181,185,193–203]. [b] Directors of environment, civil protection and emergencies, planning, public works, and social organizations, five in each municipality. Chronological record of interviews: Cauquenes, March–June 2015, March–April 2016; Concepción, La Florida, Renca, and Valparaíso, December 2015–June 2016; Lebu, October–December 2016; Panguipulli, October 2014–January 2017; Osorno and Puerto Montt, March 2016–October 2018. [c] Discussion groups organized with municipal officials, academic seminars, and workshops with chronological record April 2014–January 2021.

5.2. Qualitative Analysis: Case Selection, Data Collection, and Analysis

5.2.1. Case Selection

To analyze the quantitative findings with documented experiences in municipalities, we employed interviews applied in municipalities of territories with populations at risk regarding lack of critical infrastructure and similar geographical, social, economic, and environmental conditions, such as exposure due to their locations, climate change, natural resource dependency, accelerated urbanization, socioeconomic fragility, high environmental risk perception, and frequency of natural disasters [47,48,52,53,63,69,73–76] (Figure 4). The interviews were applied to a representative sample of 98 selected cases located in the central south of the country, where 90% of the country's population lives, composed of rural and urban communities, 44 with populations greater than 70,000 and 58 between 3000 and 70,000. Geographical selection criteria included location in coast, valley, or mountain (Figure 1), and disaster criteria were hydrometeorological, geophysical, biological, environmental, and technological with socioeconomic fragilities and need for more infrastructure [4,5,45,47,52–55,57,61,68–70,73–76,79–81,83,167–175,185].

To compare in depth and improve the quality of the study results, we selected a subsample of representative cases. We considered potential limitations in the selection of the

cases, because all Chilean municipal territories are different (surface, population, culture, economy). Guided by our research question, the hypotheses, and the need to identify cases that could contribute to understanding the findings of the quantitative analysis, we decided to apply the recognized difference criteria method suggested by John Stuart Mill to identify cases that allowed us to document and compare the effects of institutional variables. In other words, we selected the cases based on variations in the institutional variables of interest, without regard for the dependent variables. We agreed on criteria to prioritize selection of municipalities with similarities from the perspective of exposure and vulnerability, on one hand, and differences in relation to how local governments contribute to adaptation through investments in critical infrastructure, on the other.

We identified municipalities with similarities (e.g., challenging environmental conditions, socioeconomic indicators) but contrasting outcomes related to local government decisions in Investment and selected nine illustrative cases: Valparaíso in Valparaiso region (33°02′ S 71°37′ W), La Florida and Renca in Metropolitan region (33°33′ S 70°34′ W and 33°24′ S 70°44′ W), Cauquenes in Maule region (35°58′ S 72°18′ W), Concepción and Lebu in Biobio region (36°49′ S 73°03′ W), Panguipulli in Los Rios region (39°38 ′S 72°20′ W), Osorno and Puerto Montt in Los Lagos region (40°34′ S 73°09′ W and 41°28′ S 72°56′ W). The cases represent communities experiencing accelerated urbanization processes, socioeconomic fragilities, populations living at risk, and deprivation in infrastructure [47,52,53,181,193–201].

The nine communities were in need of more Investment, but the local governments contrasted in engagement and performance, as well as in citizen satisfaction with the municipalities [3,52,54,55,82,185,194–202]. In the weekly council meetings during 2009–2016, the local governments of Concepción, La Florida, Osorno, and Panguipulli discussed Investment projects (new critical infrastructure) 93 times per year on average, executed an average of 69 projects per year (40% of the total), invested an average of 2,205,149 USD of the budgetary resources in new infrastructure, and used 3404 USD per capita transferred by Undersecretary of Ministry of Interior (SUBDERE) and regional governments as complements to municipal monies [195,196,198,199]. Contrasting those cases, Cauquenes, Lebu, Renca, Valparaíso, and Puerto Montt discussed Investments with lower frequency (annual average of 29 times), executed only an average of 21 projects yearly (30% of the total), invested 547,330 USD municipal resources per year, and used the transferences of 775 USD per capita for the execution of tasks designed by national and regional programs in Maintenance [194,197,200,201].

Regarding social outcome perceptions, available data suggest that the citizens of Concepción, La Florida, Osorno, and Panguipulli manifested higher evaluations of municipal services, effectiveness of their local governments, and trust [3,52,185] (Figure 5).

5.2.2. Data Collection and Analysis

To provide robustness to the results of the quantitative analysis with documented experiences in municipalities, we used survey results from face-to-face, semi-structured interviews with directors of civil protection and emergencies of 98 municipalities in nine regions between April 2015 and December 2016, Figure 4. Other primary sources and databases were consulted to obtain additional information [47,48,52,53,57,63,66,69,73,75,76,80–83,157,158,162,163,167–171,176,177,198,199].

The qualitative analysis included in the study is based on a rigorous procedure to select and process information from primary sources (Appendix D). The data on the nine illustrative cases were collected from several sources, i.e., interviews with municipal officials, primary sources, and official data [47,48,53,66,68–70,73–76,79–83,167–172,177–179,181,185,193,203] (Figure 5).

The collected information was organized in databases to produce inputs for the analysis. A database populated with the survey data and complementary information gathered from primary sources provided inputs to produce documented observations on the 98 municipalities employing the Program SPSS 23. To go deeper into the discussion of

the quantitative results through contextualized analysis, the data collected from interviews, official records, and statistical sources were triangulated to compare among the nine illustrative cases, combining content analysis and descriptive statistical data analysis (Appendix D). These comparisons complemented the quantitative inferences.

The evidence demonstrated that the institutional dynamics and factors we found to be the most important were consistent with those found in the quantitative analyses (e.g., municipal organization robustness and accountability variables, political leadership attributes), allowing the qualitative analysis to provide more complete insights about the moderation mechanisms and processes at work.

In sum, using these procedures, we produced knowledge that fills the gap in previous research around the explanation of how capacities and political motivation translate to local government decisions.

5.3. Validity

The data for the research were collected in Chile for an in-depth study of Chile and local governments there. The possible disadvantage is that the specific results cannot be fully extrapolated to other places. We tried to reduce the effects of the disadvantages by formulating a research problem, questions, and hypotheses that are relevant in the literature on the subject and valid for research activities elsewhere [3,13]. In fact, we reviewed theories and literature on disaster risk reduction, adaptation, local governments, theories of organizations, and multilevel governance. Likewise, we were careful in the selection and operationalization of the concepts and the selection of metrics for the analyses, expecting that they could be employed by other studies in other cases, for example municipal investments (continuous variable), municipal regulations (index), and government transfers (continuous).

Although a possible disadvantage is that the specific results cannot be fully extrapolated to other places, the findings carry some validity for other low- and middle-income countries that are affected by exposure to frequent natural disasters, climate change, and vulnerability, and that urgently require more investment in critical infrastructure. One should be careful, however, in drawing too many parallels from our study's findings to these other contexts. That said, the similarities, succinctly documented in the review by the Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [13], provide external validation for the results of the study. In South America, for example, the findings on the importance of municipal organization robustness are valid for countries such as Argentina, parts of Brazil, Colombia, Perú, or México, where communities need more investment and local governments perform functions similar to those of Chile. Even for countries on other continents with similar challenges, where local governments have responsibilities to fulfill and their decisions have consequences for the well-being of the population, the results of this study are also valid.

6. Results: Quantitative Evidence and Analysis with Support of Qualitative Evidence

This section outlines the evidence. The results from four models are reported in two output tables. Table 1 presents models 1 and 2 with marginal effects of variables that represent capacities, political leadership attributes, and moderating effects of the autonomy of the municipal councils on the outcomes (model 1, Investment; model 2, Maintenance). Table 2 shows the moderating effects of the resource transfers variable "subdeinvesttrans" (models 3 and 4). The effects of the control variables are not outlined in Tables 1 and 2 in order to focus on direct and moderated effects of independent variables on dependent variables.

Table 1. Effects of capacities, leadership, and accountability as moderator.

		Model 1: Investment	Model 2: Maintenance
Capacities	partFCM_rate	**0.84614 *** **	−118.346
	medium × partFCM_rate	−1.206.112	**−5.64391** **
	high × partFCM_rate	0.3806593	−191.648
	pmarate	0.32313	199.059
	medium × pmarate	1.270.784	−435.189
	high × pmarate	1.643.535	−344.245
	perate	0.56664	341.424
	medium × perate	−1.574.757	−1.564.425
	high × perate	−4.497.749	−2.281.455
	prof_muni_rate	−0.61795	**4.77559 *** **
	medium × prof_muni_rate	0.5767846	**13.78759** ***
	high × prof_muni_rate	1.623.527	0.25064
	edumayor (technical)	−307.692	2.317.893
	medium × edumayor	−8.723.003	−15.953.990
	high × edumayor	5.397.387	−2.402.755
	edumayor (professional)	323.677	358.932
	medium × edumayor	−5.878.114	−4.888.378
	high × edumayor	3.552.982	−1.279.376
Political leadership atributtes	mayorvote_rate	0.34824	291.780
	medium × mayorvote_rate	**4.85202** ***	**−14.26488** ***
	high × mayorvote_rate	3.508.063	**−12.90603** **
	council_coalition	**−0.404916 ** **	**−1.684582 ** **
	medium × council_coalition	−0.491772	1.998.828
	high × council_coalition	−0.71.5589	1.797.725
	rulingparty	**18.42414 ** **	−1.286.452
	medium × rulingparty	−2.691.243	388.681
	high × rulingparty	1.343.677	6.652.708
	incumbent	**14.46393 ***	1.614.288
	medium × incumbent	4.585.507	10.859.117
	high × incumbent	2.184.817	5.999.462
	Controls	YES	YES
	fixed effects at the region level	YES	YES
	time fixed effects	YES	YES
	RE (municipality)	YES	YES
	adjusted Rho-squared	0.1996	0.2262
	No of observations	1626	1454

* 10%, ** 5%, *** 1% significance level. Note: The variables in gray are combinations of the variable municipal council accountability with the respective independent variables (e.g., municipal capacity and political leadership attributes variables).

Table 2. Effects of capacities, leadership, and resource transfers as moderators.

Variables	Model 2: Investment	Model 3: Maintenance
partFCM_rate	**0.95611 *** **	**−2.03521 ** **
interaction × partFCM_rate	0.00469	**−0.14008** ***
pmarate	−220.363	−1.157.431
interaction × pmarate	−0.07790	**−0.49204** *
perate	−0.21570	816.279
interaction × perate	2.080.444	**0.35228** **
prof_muni_rate	−0.61014	**4.38795 ** **
interaction × prof_muni_rate	−0.00315	**0.12606** ***
edumayor (technical)	234.609	−1.615.647
interaction × edumayor	−0.842372	−0.20869
edumayor (professional)	**−0.842372 *** **	−2.322.270

Table 2. *Cont.*

Variables	Model 2: Investment	Model 3: Maintenance
interaction × edumayor	**−1.214724** ***	−0.15584
mayorvote_rate	0.30316	**4.21960** **
interaction × mayorvote_rate	**−0.01622** *	0.02872
council_coalition	**−0.529106** ***	**−1.577342** **
interaction × council_coalition	**−0.010583** ***	**−0.357629** **
rulingparty	**16.70460** **	−2.807.512
interaction × rulingparty	−0.2678327	**−1.91807** ***
incumbent	**22.44683** ***	2.661.684
interaction × incumbent	**1.113316** ***	**3.38906** ***
control	YES	YES
fixed effects at the region level (15 regions)	YES	YES
time fixed effects	YES	YES
RE (municipality)	YES	YES
adjusted Rho-squared	0.2349	0.2543
No of observations	1626	1454

* 10%, ** 5%, *** 1% significance level. Note: The variables in gray are combinations of the resource transfer variable "subdeinvesttrans" with the respective independent variables (e.g., municipal capacity and political leadership attributes variables).

6.1. Regressions, Marginal Effects, Standard Deviation, and Median

The results of the regression models support the Alternative Hypotheses on moderating effects of municipal organization and governance relationships in terms of resource transfers.

Beginning with the direct and independent effects of capacity variables, we hypothetisized that financial and human resources are always key factors for Investment (Null Hypothesis 1). Table 1 shows that municipalities more dependent on the Municipal Common Fund (partFCM_rate variable) increase Investment and municipalities with more professional employees put more money into Maintenance. On one hand, 1% annual increase in dependence on the MCF is associated with an annual extra investment of 846 CLP per inhabitant, i.e., a municipality one standard deviation more dependent on MCF compared to the average of the sample increases Investment annually 12%. On the other hand, 1% increase in the number of professional staff predicts an increase in Maintenance of 4776 CLP per inhabitant or 20% more in Maintenance than the average municipality.

When we shifted attention to the direct and independent effects of leadership variables, we hypothetisized that political leadership attributes in its own right represents another key factor for Investment (Null Hypothesis 2). Table 1 indicates, first, where mayoral support from the municipal council in terms of political coalition representation increases by 1%, annual Investment decreases by 405 CLP per inhabitant, and annual Maintenance decreases. If mayoral coalition representation is one standard deviation higher than the average, we expect Investment in this municipality to decrease by 7%. Second, if the mayor and the national president are in the same political coalition, annual Investment increases by 18,424 CLP (13%) per inhabitant. Third, when the mayor is in his or her second term or more, annual investment increases by 14,464 CLP (10.4%) per inhabitant.

As stated in Alternative Hypothesis 1, the relationship between capacities and Investment (Maintenance) is moderated by municipal organization processes. Using the municipal council autonomy variable (iacm), that in our framework expresses accountability, model 2 (Table 1) reveals that the local government receiving more financial resources from the MCF expends less on Maintenance when the municipal council manifests more autonomy (48%). However, where a municipality has one standard deviation more professional employees and more municipal council authonomy, Maintenance increases by 58.7%.

Looking at complementary specifications, using the municipal organization variable "orgm"as the moderator (e.g., municipal organization with planning, performance agreements, interdepartmental coordination, integration), models 5 and 6 (Table A5) result in a

1% increase in the dependence on the MCF associated with an 8484 CLP per inhabitant rise in Investment when the municipal organization is highly robust (122%).

With respect to the hypothesized moderating effect of the municipal organizational dimension on the relationship between political leadership attributes and Investment (Alternative Hypothesis 2), the mayor's electoral support becomes statistically significant when it is moderated by a higher level of council autonomy, models 1 and 2 (Table 1). Each extra percentage point of the mayor's winning votes is associated with increased Investment where the municipal council shows more autonomy (35%). Model 5 (Table A5) also shows that an extra percentage point in the mayor's electoral support is associated with 38,268 CLP increase in Investment when the organization is more robust. If the mayor was elected with one standard deviation more votes than the average, we expected that municipalities with higher organizational robustness will increase Investment by 160%.

The fitted models reported in Table 1 explain 20% of the observed heterogeneity in the output variables.

Table 2 displays model estimates of capacities, political leadership atributtes, and moderating effects of resource transfers.

Returning to the Null Hypothesis 1, Table 2 shows that the direct and independent effects of capacity variables on Investment and Maintenance decision outcomes generally align with the effects reported in Table 1 in terms of direction and magnitude. Centering the attention on the direct effects of political leadership attributes variables on Investment and Maintenance decisions (Null Hypothesis 2), the results in Table 2 again exhibit strong consistency with the models reported in Table 1. Nevertheless, in model 4, a new effect emerges. One percent increase in a mayor's voting support increases Maintenance by 4220 CLP, i.e., if a mayor's electoral support is one standard deviation larger than the average, we expect Maintenance to increase by 42,200 CLP (18%).

With respect to the Alternative Hypothesis 1, i.e., moderating influence of resource transfers interacting with capacity variables, if transfers increase by 1000 CLP per inhabitant, Investment decreases by 1215 CLP per inhabitant, where local governments are led by mayors with tertiary education (compared to those whose mayors do not have bachelor's degrees). If we double the amount of median transfers that municipalities receive, Investment decreases by 14,580 CLP (10.5%) in municipalities led by mayors with tertiary education. Regarding Maintenance, a 1000 CLP increase in transfers is associated with a decrease in Maintenance by 140 CLP, where a municipality is 1% more financially dependent on the MCF, and by 492 CLP where staff connected to environment-related activities increases by 1%. If we double the median transfers in municipalities that have one standard deviation more workers of this type, Maintenance decreases by 29,520 CLP (12.5%) with respect to the average Maintenance in our sample. The increase in transfer is also connected to an increase in Maintenance by 352 CLP where the personnel working on civil protection and emergency-related activities increase by 1%. If we double the median transfers in a municipality that has one standard deviation more workers in this category, Maintenance increases by 12,672 CLP (9%). The increase in transfers induces further increase in Maintenance by 126 CLP for each additional percentage point of professional employees working for the municipality.

With regard to the moderating consequences of transfers on political leadership attributes (Alternative Hypothesis 2), models 3 and 4 indicate the following effects. First, each extra percentage point of a mayor's winning votes in the election interacting with more transfers decreases Investment by 16.2 CLP (1.4%). Second, for each additional percentage of mayoral political representation in the municipal council (same political coalition) and increase of transfers, Investment decreases by 10.5 CLP (2.2%) and Maintenance by 358 CLP (43%). Third, Maintenance decreases by 1918 CLP (9.7%) in municipalities where the mayor is in the same party coalition as Chile's president and that receives more transfers. Fourth, Investment increases by 1113 CLP (9.6%) and Maintenance by 3389 CLP (17.3%) in municipalities with mayors that are in their second term or more and that receive more transfers.

The overall fitting of the models is 23.5% for Investment and 25.4% for Maintenance.

6.2. Analysis of the Findings with Support of Qualitative Evidence

Based on estimated models (Tables 1 and 2, Tables A3–A5), we put confidence in Alternative Hypotheses 1 and 2 about moderation effects on the outcomes. The evidence suggests that there are conditional effects of capacities and political leadership attributes variables of mayors on local government decisions and their outcomes, and that municipal organization variables and incentives of the resource transfers seem to moderate the effects of those variables. The variables that represent the political qualities of leadership appear quantitatively more important than the municipal capacity variables to explain Investment. The municipal organization variables have the most quantitatively important moderating effect in some capacity and leadership variables. The resource transfers variables moderate a larger number of variables, but they do not have so much impact.

6.2.1. Financial Resources, Professional Staff, Political Leadership Atributtes

Concerning direct and independent effects, two capacity variables are particularly relevant to explain local government decisions in Investment and Maintenance: MCF and professional staff.

Chilean municipalities more dependent on financial resources from the MCF invest more in resilient critical infrastructure, approximately 12% more than the average. We interpret the result as desirable and positive, because most of the communities need more resilient infrastructure to reduce socioeconomic fragilities, deprivation in infrastructure, and address the challenging environmental conditions [3,48,51–53,56].

Consistent with theories of internal organization and findings by sustainable cities [1–3,72,89,90,94], the evidence from Chile suggests that municipal professional staff is devoted to executing managerial tasks in Maintenance rather than working on planning and Investment. The behavior of Chilean public servants is shaped partly by the weight of the inherited legalistic tradition [51,185], reinforced by Chilean governments during the last four decades [48,50,184,187,204,205]. The Chilean legislation prescribes continuity for most municipal employees, depending on the performance of encoded and monitored functions, and most of the municipal professionals make their careers within the same municipality [204]. Furthermore, the municipalities must fulfill shared functions with several public organizations; therefore, municipal workers are usually stressed trying to fulfill several objectives in Maintenance at the same time, with overlapping functions and often contradictory goals [51].

In the survey applied to the sample of 98 municipalities, 83% of professional officials reported compliance with what is indicated by law and by higher senior authorities [56]. Regarding the nine illustrative case studies, the available council meeting minutes document recurrent behaviors of senior professional officials during 2009–2016: commitment and evaluations according to encoded norms that justified the prioritization of efforts on Maintenance in council meetings and study commissions [194–202]. Some interviewed officials confirmed that Maintenance is part of the essential functions of the municipalities, encoded in norms (Figure 5). In sum, encoded prescriptions and administrative procedures, linked to the inherited centralized legal framework, operational rules, and probably other conditions such as managerial organization goals, stability, and promotion, explain conservative behaviors by the municipal professionals, prone to favoring the status quo in managerial Maintenance.

With respect to political leadership attributes, the literature proposes relationships between electoral behavior, local government decisions, and outcomes [41,103,118]. In Chile, the electoral support for mayors is associated with more Maintenance. However, the evidence from different assessments, studies, and surveys report that most of the communities are in need of Investment [51–53,56,59–61]. In the survey and in interviews during the research of this study, on average, mayors declared their commitment to more Investment [3,56] (see sources in Figure 4). In five of the nine illustrative cases (La Florida,

Concepción, Osorno, Panguipulli, Valparaíso), most of the interventions of mayors in weekly municipal council meetings focused on new Investments [195,196,198,199].

The reasons for the apparent paradox have to do with the institutional context and incentives. The mayors with electoral support must show concrete results in Investment during their four-year period of governance or, if it is not possible, in Maintenance. Their decisions are contingent on several factors that are not always under their control. For example, the earthquake of February 2010 (magnitude 8.9) determined the priorities of the local governments in Concepción, Cauquenes, and Lebu for one year [194,195,197], and financial problems inherited from past administrations became decisive in the budgetary decisions of other municipalities [194,200].

The literature reports that municipal council support affects local government outcomes in the emerging policy domain such as planning [2,3,35,36,89]. In Chile, the mayoral political coalition representation in municipal councils decreased Investment. This result reveals links between local politics and outcomes in the following dimensions. First, political electoral competition in Chile began to be highly polarized in the first half of the 2010s [206]; local politicians tended to prioritize expenditures on issues guided by political compromises and electoral calculation [4,61,207]. Second, the combination of mayoral personalized administration and lack of political competition (balance) fostered laziness within the local government, weakening accountability [163]. The documented routines in municipal council meetings of the nine illustrative cases provide evidence of those dynamics [4,54,55,61,194,197,200–202]: compromises in municipal councils with agendas where Investment was not thematized in Renca, Cauquenes, Lebu, Valparaíso, and Puerto Montt. In the cases of Concepción, La Florida, Osorno, and Panguipulli, where the councils were politically divided, councilors manifested awareness of their prerogatives and pressured for more performance in Investment [55,61,157,195,196,198,199].

The literature of sustainable cities reports that the continuity of decision makers is relevant in emerging policy domains, for example, the first stages of adaptation planning [2,3,35]. The evidence of Chile consistently shows that incumbency of the mayor increases Investment. The achievement of Investment projects may take years because the preparation requires several studies and procedures [82]. The experiences of four illustrative cases (Concepción, La Forida, Osorno, and Panguipulli) of the municipalities with higher Investment show that continuity was relevant [55,195,196,198,199].

According to the literature review, political support at other scales of governance may open opportunities to advance in emerging local government agendas [3,36,98,102,103]. In Chile, the regressions consistently show that closeness of the mayor to the ruling party increases the likelihood of Investment. For instance, the mayor of La Florida belonged to the ruling party in the center-right government of President S. Piñera (2010–2013) and the political support facilitated access to technical and financial aid to carry out important projects for the community [196]. Investment also increased during the second term because access had been established via experience and political association.

6.2.2. Municipal Organizational Arrangements

The reviewed theories and experiences in sustainable cities suggest that some attributes of municipal organization create differences between local governments in adaptation planning [1–3,13]. In Chile, the municipal organization robustness presents the most quantitatively important moderation effect. For example, the largest moderating effect on the relationship between mayor electoral support and Investment (160%) is driven by the level of robustness in municipal organization in view of internal regulations, planning, coordination, and integration. Likewise, local governments that receive more financial resources from the MCF and have high municipal organizational robustness invest more (122%).

The results of the survey further indicate that 25 municipalities (25%) with plans for DRR and climate change adaptation reported more engagement than the average of the sample in activities related to DRR, climate change adaptation, and infrastructure Investment, while 43 municipalities (44%) without planning were below the average [56].

In 57 municipalities with more organizational robustness than the average, civil protection and emergency directors participated in activities related to infrastructure investment, whereas directors did so only in nine municipalities of the group with a lower degree of robustness. A comparison of illustrative cases shows how these interactions operated. In Panguipulli, Osorno, La Florida, and Concepción, DRR, environmental protection, and infrastructure planning were highly institutionalized, with collaboration between departments and more integration than in other cases [4,16,54,55,61,195,196,198–200]. From the mid-2000s, the local governments of those four municipalities introduced reforms in the municipal organization, such as internal regulations to improve management, institutionalization of departments for risk management and environmental protection, and plans with performance agreements and monitoring systems [55,61,195,196,198,199]. These changes incentivized increased awareness and engagement regarding citizens' needs, risk reduction, goal improvements, organizational reoutines, and new investments.

For example, the local government of La Florida introduced planning and macrological procedures in all departments, more coordination and integration, and accountability in the routines of each unit [196]. At the same time, La Florida invested in GIS technologies and training to improve information flow on territorial issues and interdepartmental integration. Planning, coordination, integration, and access to accurate information optimized municipal activities, and facilitated the execution of several projects in road infrastructure and urban improvement during 2009–2016. In Concepción and Panguipulli, we observed similar paths [55,61,195,198,199]. In a clear divergence, Puerto Montt, Valparaíso, and Renca lacked planning, operated departments in isolation, conditioned assessments and government decisions to the discretion of mayors, senior officials, and councils who did not prioritize Investment, and had contrasting outcomes [4,16,54,55,61,200–202].

The juxtaposition of cases also shows how organizational robustness moderates other factors. For example, in La Florida, the opportunities for investments depended not only on the motivation and electoral support, but on municipal organization robustness to perform in terms of recurrent routines (prioritizing the subject, management, assessments, studies, applications, and execution) [196]. Furthermore, the implementation of the institutionalized plans (e.g., community development, DRR, infrastructure) and the robustness of the municipal organization yielded additional funds from the MCF for Investment [185,196]. The consequence of viogorous municipal organization, mayoral electoral support, and transfers was an exponential leap in Investment after 2011, higher when compared to the previous period and other municipalities [196]. The trajectories of Cauquenes, Lebu, Puerto Montt, Renca, and Valparaíso reveal clear contrasts, i.e., municipal plans that declared goals, not having scheduled and responsible execution or performance agreements, contradictory operational rules, personalized administrations, municipal departments working as silos, civil and environmental protection units marginalized within organizations, frequent administrative problems affecting efficiency in outcomes, and low Investment [194,196,197,200–202].

The reviewed literature suggests that accountability practices are important organizational attributes for performance with equitable provision of public goods [3,41,55,130,131,148,159]. In the regression models, municipal council accountability becomes quantitatively relevant in positively moderating the effect of mayoral electoral support for Investment. Municipalities with higher municipal council accountability governed by mayors with high electoral support invested 35% more than the average of local governments.

In Chile, the grade for municipal council accountability is contingent on municipal institutional arrangements such as internal regulations and displayed by weekly council meetings and study commissions [3,55]. As policy makers, the councilors are in position to provide valuable information, disseminating awareness on issues, introducing frameworks, deliberation, and voting. In Concepción, La Florida, Osorno, and Panguipulli, municipal councils with high degrees of accountability granted by internal regulations proactively supported Investments (e.g., disseminating awareness, requesting information, assessments, and proposing projects to improve infrastructure) [4,16,54,55,61,196,198,199]. By

contrast, the municipal institutional arrangements of Cauquenes, Puerto Montt, Renca, and Valparaíso restricted their municipal councils' autonomy [194,200–202].

6.2.3. External Institutional Dynamics (e.g., Governance Relationships)

With reference to governance relationships, international frameworks in the literature and one part of the literature on sustainable cities propose multilevel interactions as key to progress in emerging policy domains at the local level [3,5–7,12–14,43]. In Chilean municipalities, these dynamics moderate a large number of capacities and political leadership attributes variables, but they have less impact from a quantitative point of view. For example, the national government transfers did not affect the path of the professionals. In some cases, such as Cauquenes, Lebu, and Puerto Montt, those transfers introduced more incentives for Maintenance, because the professionals wanted to devote more time or effort to doing their jobs better, rather than start new projects in uncharted territory [4,55,61].

7. Conclusions

In the conclusion, we summarize some of the challenges of our study "Causes and Consequences of Local Government Efforts to Reduce Risk and Adapt to Extreme Weather Events: Municipal Organizational Robustness" in terms of results, achievements, advances in relation to previous studies, relevance, contributions, problems and possibilities in generalizing, limitations, and practical implications.

Seeking to enhance understanding of how organizational capacities and political dimensions of mayoral leadership are translated into decisions, this study realized as a starting point that capacities and underpinning factors for mayoral leadership (electoral, municipal council, political support, and continuity) may explain local government decisions concerning Investment. However, from another point of view, we hypothesized that institutional dynamics (e.g., municipal organizational arrangements and governance relationships) take part as moderators in the complex configuration of factors that connect capacities, political leadership attributes, and outcomes. With collected data from 345 typical Chilean municipalities, we explored those hypotheses, emerging conditional relationships between capacities, the leadership attributes, and outcome variables. Both quantitative evidence and analysis supported by qualitative evidence indicate the relevance of interactions between municipal institutional arrangements, capacities, leadership attributes, and outcomes, and, therefore, the relevant roles of organizational robustness, and accountability. The evidence supports our Alternative Hypotheses 1 and 2, insofar as the relationships between explanans and explanandum are conditioned by moderating variables. Hence, we conclude that the connection between political leadership attributes, capacities, and Investment in Chile depend to a large degree on the municipal robustness in terms of operational rules, planning, coordination, integration, and accountability.

With respect to achievements, the research conducted led to an explanation about how capacities and leadership translate to local government decisions and outcomes regarding adaptation in terms of critical infrastructure. The study fills a gap in the literature through analysis of theories, case studies, a suitable model specification, methodological design with mixed methods, results, and a deeper discussion of the evidence. Similar to earlier researchers, we already knew the relevance that several factors might have to local adaptation, such as capacities, leadership, framing, intergovernmental relations, data and assessment, and social participation; for example, financial resources or leadership motivation were important, but we did not know the relative importance or the institutional mechanisms that work to make those factors effective and relevant. Now, we have knowledge and the opportunity actually to increase the effects of capacities and leadership by improving the municipal organizational robustness. Since one of the objectives of the Special Issue "Bringing Governance Back Home—Lessons for Local Government Regarding Rapid Climate Action" is to explore how action is enabled or constrained by institutional relations in which the actors are embedded, this study contributes to achieving that goal.

The explanation about causes and consequences of municipal institutional arrangements is the study's most important contribution to the areas of DRR, climate change adaptation, and sustainability science. As for possibilities for future research in this respect, greater integration of conceptual frameworks, theories, research methods, and evidence-based knowledge on the subject will facilitate suitable recommendations for local decision makers, increasing the likelihood that political leaders will contribute to pursuing sustainability.

In terms of contributions to theoretical areas, the Chilean experience teaches us that performance is not granted by capacities or leadership motivation per se. Mayors, as political leaders and decision makers motivated or not by adaptation, make decisions based on features of the organizational systems in which they are embedded. We expect that any improvement in the municipal organizational system increases the probability of moving forward from leadership motivation to results. Hence, we conclude that whenever there is balance from the point of view of municipal political–administrative configuration (e.g., mayors with electoral support and powers to administer the municipality, organizational robustness, and councilors with the ability to enforce accountability), the probability to advance with local government decisions in the emerging policy domain of adaptation becomes greater. This conclusion implies that where more investment in resilient critical infrastructure is required, organizational robustness and accountability are essential ingredients to achieve progress, making it possible for capacities and political will to translate into decisions and actions.

Other countries have similar problems with respect to frequent disasters and negative effects of climatic change, for example neighboring countries. Specific risks might be different there, but their struggles with local climate change adaptation are similar enough that we expect our results in Chile to be relevant for their local government decision-making. In Asian and African countries where the threats are not too different from Chile's, our results may also be relevant. Our findings about moderating effects and relationships are potentially useful there, as well as the concepts that municipal organization and political support are big factors to see concrete results.

Regarding limitations, one issue of our research was the lack of accurate information and data before 2009. We would have liked to do a longer study in terms of years covered, but it was impossible to find accurate official data due to lack of transparency in national legislation pre-2009. Another limitation was the irregular quality of the data. To a certain degree, we overcame those limitations through the analytical operationalization of concepts, taking into consideration the availability of data, critical selection of metrics related to hypotheses, data collection from several sources with available information, requests for data for purposes of transparency, data normalization, observation of central tendency measures for the quantitative analysis, application of rigorous criteria for variable selection, accurate selection of control variables, rigorous selection of representative cases, and sources of information for the qualitative analysis, among others. A further limitation was related to our causal inferences—the strategy of using a "control function" is not perfect, and may have been a possible source of omitted variable bias. Even though the random effect Tobit model fits the sample data better than the standard linear model (e.g., it captures the fact that several local governments do not invest), we could not control by fixed effects using "within estimators." To alleviate this potential source of misinterpretation, we included a rich set of mutually uncorrelated exogeneous controls. In addition, we compared and analyzed the results of the partial test with an independent rigorous analysis of qualitative evidence.

Finally, we describe the study's practical implications more precisely as follows. First, the contribution to increased local government decisions on adaptation is the central importance of municipal organization robustness in terms of operational rules, communication and coordination, integration, accountability, and political support. Hence, we recommend enhancing municipal organizational robustness, because it will moderate capabilities, political support, and maybe other factors in the right direction. Second, because those factors

contribute to translating capacities and motivating to local government decisions, we identify an opportunity actually to enhance efforts to reduce risk and adapt to extreme weather events. Third, monetary transfers coming from national and regional governments are undoubtedly desirable ingredients for a fertile adaptation, but not as cardinal as internal managerial robustness; therefore, the process is like a bottom-up public policy to reinforce robustness, which is more effective connecting capacities, motivation, and decisions than a top-down policy of transfers or other types of external interventions (e.g., external scientific community championing adaptation, structured social participation in the municipalities, governance networks exchanging information and frameworks). Fourth, international cooperation and national and regional public policies could target public resources and decrease the frustrations of practitioners more efficiently if they place more attention on bottom-up local government robustness, like municipal operational rules, internal coordination, integration and flexibility, or transparency and accountability, i.e., the support and money from outside will go much farther or will do a lot more good only if the local robustness is strong.

Author Contributions: K.P.A., P.N., and P.V., conceptualization, formulation of the overarching research goals and aims, title, abstract, introduction, literature review, framework, methodological design, results, discussion, conclusion, and references; P.N. and P.V., methodology and software; K.P.A., P.N., and P.V., validation; P.N. and P.V., formal analysis; K.P.A., P.N., and P.V., investigation; K.P.A. and P.V., resources; P.V., data curation; P.N., and P.V., writing—original draft preparation; K.P.A., P.N., and P.V., writing—review and editing; P.V., visualization; P.V., supervision; P.V., project administration; P.V., funding acquisition. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Fund for Scientific and Technological Development (FONDECYT), National Research Agency of Chile, grant number 1181282; National Science Foundation, grant numbers DEB-1114984, SMA-328688, SES-1757136, and DGE-1650115; the Belmont Forum, grant number T2S-789.

Institutional Review Board Statement: The research was conducted according to the guidelines of the Declaration of Helsinki, approved by the Institutional Bioethics and Biosafety Committee of the Universidad de los Lagos, Chile (dates: 20 April 2015; 12 April 2018), and the Human Research Ethics Committee of the Universidad Austral de Chile (date: 25 June 2020).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study (e.g., interviews, survey).

Data Availability Statement: We used the data of Figures 2–5, and Table A1, most of which are publicly available. For some analyses, we used our own datasets, which are available upon request.

Acknowledgments: P. Valdivieso acknowledges financial support from the National Fund for Scientific and Technological Development (FONDECYT), Grant # 1181282. We appreciate useful comments received by anonymous referees and one unidentified guest editor of the Special Issue. We express our gratitude to twenty seven undergraduate and eleven graduate students (U Austral Los Ríos region, U Concepción Biobio region, U Lagos Los Lagos and Metropolitan regions, U Chile Metropolitan region, UFRO and U Arturo Prat Araucanía region, U Viña del Mar Valparaíso region), twelve professional collaborators (National Institute of Statistics, National Office of Emergency Los Lagos, National Women's Service Valdivia, German School Santiago, U Arturo Prat, U Austral, U Concepción, U Chile, U Lagos Chile, UFRO), Demoscopica Opinion Studies Group, and J. Broderick (editorial assistance) for research support. We express gratitude also to senior officials of 98 Chilean municipalities who welcomed us, shared their time, and expertise with us. We also benefited from constructive comments on research steps, progresses, and drafts of the study by attendees of the 2018, 2019, 2020, and 2021 bimonthly Institutional Analysis Workshop "Institutional Drivers of Environmental Disaster Reduction Management: A Comparative Study of Local Government Decisions and Outcomes in Chile" (available at http://www.gobernanzamedioambiental.cl/, accessed on 11 July 2021), Millennium Institute for Research in Market Failures and Public Policy workshops (U Chile, Chile), Midwest and Western Political Science Association annual conferences (Chicago, IL, USA; San Diego, CA, USA), World Congress of the International Political Science Association (Lisbon, Portugal), International Americanists Congress (U Salamanca, Spain), International Congress of Solid Waste Infrastructure

(UAM, Peru), Risk Reduction and Sustainable Development Conference (U Concepción, Chile), and twenty workshops and discussion groups (U Austral de Chile, U Concepción, U Los Lagos).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Descriptions of independent and control variables.

Variable	Description	Measurement
partFCM_rate	Municipal Common Fund in the total budget [a]	Percentage
Pmarate	Municipal staff working on the environment [a,b]	Percentage
Perate	Municipal staff working on civil protection [a,b]	Percentage
prof_muni_rate	Staff holding a bachelor's degree [a]	Percentage
edumayor (technical)	Mayor's education, up to technical [a, b]	1, up to technical education; 0, otherwise
edumayor (professional)	Mayor's education, college or more [a,b]	1, college or more; 0, otherwise
mayorvote_rate	Mayor's winning votes in the election [a]	Percentage
council_coalition	Councilors in the political coalition of the mayor [a]	
Rulingparty	Elected president in the political coalition of the mayor [a]	1, mayor and president in the same political coalition; 0, otherwise
Incumbent	Continuity in office [a]	1, mayor is in a continuing appointment; 0, otherwise
Iacm	Municipal council accountability index [a,b]	0, low or base; 1, medium; 2, high
Orgm	Municipal organization index [a,b]	
transptotal_rate	Compliance with standards of transparency [a]	Percentage
Subdemanagtranshab	Transfers to improve management [a]	Thousands of annual Chilean pesos (CLP) per inhabitant
Subdeinvesttranshab	Transfers to improve urban equipment [a]	
gastranscor_reghab	Regional government transfers [a]	
horizontal_networkhab	Transfers to and from other municipalities [a]	
Coastline	Location on the Pacific coast [a]	1, coast; 0, otherwise
valley-mountain	Location in valley or mountain [a]	1, valley; 0, otherwise
Size	Surface [a]	Square kilometers
Rainfall	Rainfall, annual [a]	Millimeters
Temperature	Temperature, annual average [a]	Celsius degrees
Density	Population divided by surface [a]	Ratio
ethnic_rate	Indigenous population [a]	Percentage
urb_rate	Population residing in urban areas [a]	Percentage
pover_rate	Poverty[a]	Percentage
unemploy_rate	Householders reporting not having a job [a]	
no_illegal_settlements	Agglomerations with population living at risk [a]	Number
num_eve_clim_hig	Extreme weather events and disasters 1971–2014 [a]	Number
num_eve_clim	Decrees in areas of water scarcity 2008–2016 [a,c]	
earqk10_scale	Earthquake 2010 intensity [a]	Mercalli scale
earqk10_deaths	Earthquake 2010 deaths [a]	Number
Reported	Declarations of emergencies [a,c]	
num_plantacontrata	Municipal employees [a,b]	Number
cap_region	Distance from the regional capital [a]	Kilometers

[a] Reliable data from public sources with available information [47,48,53,57,68,69,73,76,79,81,167–172,175,177–179,181,185,193]. [b] Municipal secretaries, planning offices by request, websites. [c] General Water Office, Library of Congress, and Ministry of Agriculture by request.

Appendix B

Table A2. Descriptive statistics of variables.

Variable Name	Measure	Average	Median	Std. Dev.
population	Number	50,040	18,148	77,496
investment	×1000 annual CLP per inhabitant	139.3	28.7	550.7
maintenance	×1000 annual CLP per inhabitant	235.0	72.6	864.5
partFCM	Percentage	47.3%	49.7%	20.1%
num_plantacontrata	Number	109	52	163
prof_muni_rate	Percentage	27.3%	25.9%	10.4%
pmarate	Percentage	1.0%	0.0%	5.2%
perate	Percentage	0.7%	0.0%	3.4%
edumayor	0, Without tertiary education (base)	22%	–	–
	1, Technical education	17%	–	–
	2, Professional education	61%	–	–
mayorvote_rate	Percentage	49.8%	49.5%	10.0%
council_coalition	Percentage	30.8%	33.3%	23.9%
rulingparty	1, Mayor and president in the same political coalition; 0, Otherwise	37.5%	–	–
incumbent	1, Mayor is in a continuing appointment; 0, Otherwise	51.4%	–	–
iacm	0, Low (Base)	19%	–	–
	1, Medium	42%		
	2, High	39%		
orgm	0, Low (Base)	22%	–	–
	1, Medium	72%		
	2, High	5%		
transptotal_rate	Percentage	53%	55.2%	25.8%
subdeinvesttrans	×1000 annual CLP per inhabitant	50.52	11.88	232.00

Note: partFCM, proportion of municipal budget from the Municipal Common Fund; pmarate, percentage of municipal staff working on environmental issues; perate, percentage of municipal staff working on civil protection; prof_muni_rate, percentage of municipal staff holding a bachelor's degree; edumayor, mayor's education level; mayorvote_rate, percentage of mayor's winning votes in election; council_coalition, percentage of councilors in same political coalition as mayor; iacm, municipal council's accountability index; orgm, municipal organization index; transptotal_rate, percentage of compliance with transparency standards; subdemanagtrans, amount of annual monetary transfers per capita to improve management; subdeinvesttrans, amount of annual monetary transfers per capita to improve urban equipment; gastranscor, amount of annual monetary transfers per capita from regional government; horizontal_network, amount of annual monetary transfers per capita between municipalities; CLP, Chilean pesos.

Appendix C

Simplified version of the model, xttobit command syntaxis.

$y_{it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \beta_3 x_{1it} x_{2it} + Controls + \varepsilon_{it}$, where controls include all relevant variables and dummy variables such that $E(\varepsilon_{it}|x_{it}, z_{it}, controls) = 0$. ε_{it} is a unit-specific random effects component.

1. Parameters (β_0, β_1, β_2, β_3) estimation: xttobit y controls x_1##(x_2), ll(0) tobit
2. Marginal effects—post estimation commands:
   - 2.1. Direct effect: dydx(*) predict (ystar(0,.))
   - 2.2. Moderating effect of x_2 on the effect of x_1 on y
     - 2.2.1. Case 1, x_1 and x_2 are continuous:

margins, expression(normal(xb()/(sqrt(e(sigma_u)^2 + e(sigma_e)^2))) * (_b[x_1] + x_2*_b[x_1#x_2])) dydx(x_2)

2.2.2. Case 2, x_1 is categorical and x_2 is continuous:

margins x_1, dydx(c. x_2) pwcompare

2.2.3. Case 2, x_1 and x_2 are categorical:

margins x_1, dydx(i, x_2) pwcompare

Appendix D

Case selection, data collection, and data analysis, complementary information

Chile is a unitary and centralized republic with a presidential system (Figure A1). Until 2016, the country was territorially divided into 15 regions, 54 provinces, and 346 communities (entities with cities, towns, villages, and rural areas) (Figures A2 and A3). Each regional government was headed by an intendant, appointed by the President of the Republic, and a regionally elected council represented the communities. The national ministries had regional secretariats subordinated to the intendent's authority. The administration of each province was headed by a governor appointed by the President of the Republic, exercising powers in accordance with the instructions from the regional intendant. The local government of each community consisted of a mayor and a municipal council elected directly by the residents for a period of four years, which could be renewed.

Chile	Unitary and centralized republic
	Presidential system
	Ministries, regional, and provintial authorities designed by the Presidency
Deconcentration	Ministerial regional secretariats (24)
	Regional intendants (16)
	Regionally elected councils (16)
	Province governors (54)
Decentralization	Municipalities (346)
	Entities with cities, towns, villages, and rural areas
	Local governments: mayor and municipal council, elected

Figure A1. Administrative-political structure in Chile, 2009–2016 [46,49].

Appendix D.1 Case Selection

We selected municipalities located in south-central Chile, where 90% of the country's population lives and which had populations at risk regarding geographical and environmental conditions, socioeconomic fragilities, and need for more infrastructure (Figure A3).

Figure A2. Chilean regions, 2009–2016 [46].

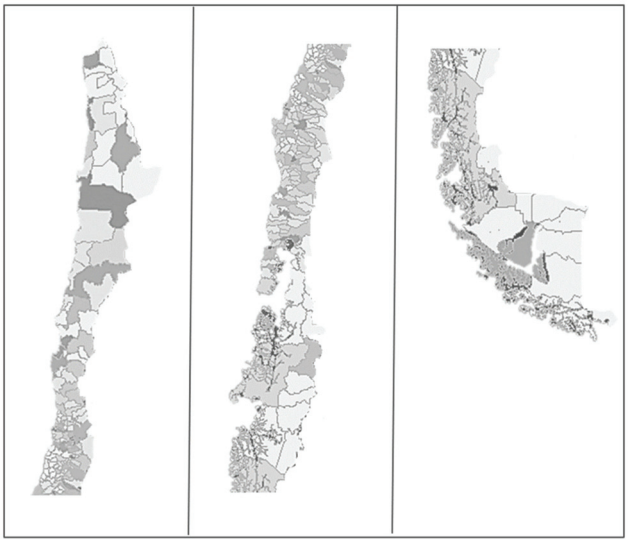


Figure A3. Chilean municipalities, 2009–2016 [45]. Most of Chile's population live in municipalities located in the center south of the country.

Location	Coastline
	Valley
	Mountain range
Population	44 cases with population greater than 70,000
	58 cases with population between 3000 and 70,000
Risk	Environmental conditions
	Climate change
	Socioeconomic fragilities
	High risk perception
	Lack of critical infrastructure
Disasters	Hydrometeorological
	Geophysical
	Biological
	Environmental
	Technological

Figure A4. Selection criteria.

Appendix D.2 Data Collection

We systematically worked on the information during 2016–2021, obtained missing documentation by requesting complementary information from municipalities, ministries, and public services, and triangulated different sources of information on the same matters of interest (Figures 2 and 5 and Figure A12). For example, we collected information on investments through semi-structured interviews in the case-study municipalities, and from official data and consultations by correspondence, telephone, and active transparency. In order to complete the list of transfer agreements in the illustrative nine cases during 2009–2016, we first reviewed the list of agreements for each year available in the active transparency sections of the municipal websites, the municipal decrees of the same period, and registry of collaborators in the Ministry of Economy, complementing it with a detailed reading of the annual public accounts of the mayors, and validating the information produced with municipal officials (interviews, focus groups, and passive transparency).

In our study, we used semi-structured interviews applied face-to-face to a sample of functionaries of 98 municipalities. The interviews were designed to be applied to municipal officials with managerial positions, conducted by the contracted professional Group Demoscopica and researchers of the National Fund for Scientific and Technological Research, FONDECYT between April 2015 and December 2016 (Figure 4). All the directors of civil protection and emergencies agreed to participate in the study, while participation of the other officials was around 30%. For this reason, we included in the qualitative analysis only the responses of directors of civil protection and emergencies for comparison.

Protocols, design	Guidelines
	Questionnaire
	Open and closed questions
	Informed consent
Contact strtategy	Mail
	Telephone
	Face-to-Face
Training	Protocols
	Researchers
	Students
	Demoscopica Group
Application	Municipalities
	Face-to-Face
	Recorded interviews
Control and validation	Demoscopica Group
	Principal Researcher
	Assistant researchers

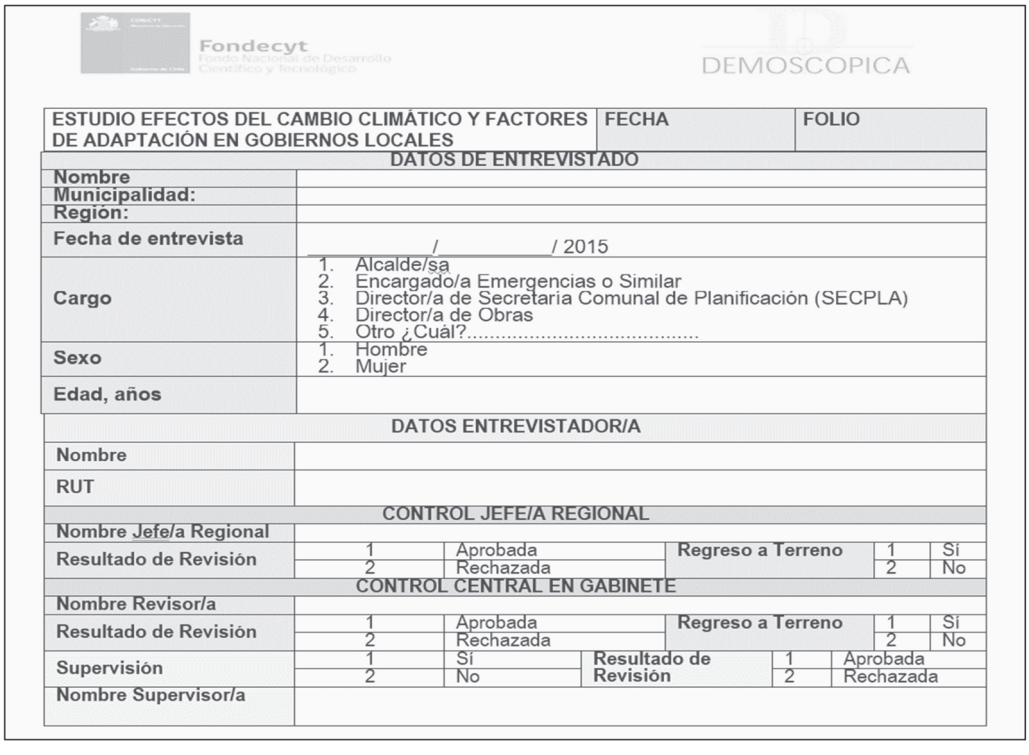
Figure A5. Semi-structured interviews in municipalities, steps [56].

Demoscopica GROUP	79 municipalities, nine regions
	159 senior officials
	April 2015 and March 2016
Researchers National Fund for Scientific and Technological Research, Chile	19 municipalities, six regions
	45 senior officials
	April 2015 and December 2016

Figure A6. Semi-structured interviews in municipalities, sample [56].

Mayor office
Planning office
Public works office
Social well-being office
Civil protection and emergencies office

Figure A7. Five types of municipal officials with managerial positions [56].



Fondecyt
Fondo Nacional de Desarrollo Científico y Tecnológico

DEMOSCOPICA

ESTUDIO EFECTOS DEL CAMBIO CLIMÁTICO Y FACTORES DE ADAPTACIÓN EN GOBIERNOS LOCALES	FECHA	FOLIO

DATOS DE ENTREVISTADO	
Nombre	
Municipalidad:	
Región:	
Fecha de entrevista	_____/_____/ 2015
Cargo	1. Alcalde/sa 2. Encargado/a Emergencias o Similar 3. Director/a de Secretaría Comunal de Planificación (SECPLA) 4. Director/a de Obras 5. Otro ¿Cuál?.....
Sexo	1. Hombre 2. Mujer
Edad, años	

DATOS ENTREVISTADOR/A	
Nombre	
RUT	

CONTROL JEFE/A REGIONAL						
Nombre Jefe/a Regional						
Resultado de Revisión	1	Aprobada	Regreso a Terreno	1	Sí	
	2	Rechazada		2	No	

CONTROL CENTRAL EN GABINETE						
Nombre Revisor/a						
Resultado de Revisión	1	Aprobada	Regreso a Terreno	1	Sí	
	2	Rechazada		2	No	
Supervisión	1	Sí	Resultado de Revisión	1	Aprobada	
	2	No		2	Rechazada	
Nombre Supervisor/a						

Figure A8. Semi-structured interviews in municipalities, protocol [56].

The protocol of the semi-structured interview contained 33 open and pre-coded questions (Figure A9).

Risk perception
Experiences (extreme weather events, disasters)
Programs and actions for DRR
Municipal organization
Coordination and interactions (experience, frequency)
Integration
Municipal council
Planning (e.g., date, reasons, update, personnel,, funds)
Governance
Performance (agreements, evaluations)
Data, sources of information
Demographic data

Figure A9. Open and pre-coded questions (total of 33) [56].

We employed several programs to populate databases and produce inputs for the analysis (Figures A10 and A11).

Statistics	Excel, Microsoft 365
	Mathematica, Wolfgram 11.3
	SPSS Statistics 23
	Statistics/Data Analysis (STATA), 14.0 and 16.0
Content analysis	NVivo 2018
	ATLAS.ti 8 Windows

Figure A10. Programs employed in data analysis.

Statistics
•Programming •Testing data consistency •Coding/recoding •Frequencies and percentages •Central tendency analysis •Association test •Regressions
Content analysis
•Descriptive coding •Recurrence coding •Interpretive coding •Sequence of thematic analysis •Metainterpretations
Validation of results
•Workshops •Thesis projects

Figure A11. Procedures employed in data analysis.

The research team (senior researchers, undergraduate and graduate students, and professional collaborators) searched document sources and conducted semi-structured interviews with qualified informants in the nine selected cases (Figure 4). Through FONDECYT (National Fund for Scientific and Technological Research) projects, we conducted semi-structured interviews with municipal officials (directors for environment, emergencies, planning, public works, social well-being), with questions on DRR, adaptation planning, critical infrastructure investments, capacities, leadership, organization, multilevel governance, and perceptions (e.g., climate-change, risks, coordination). The application of interviews included: (1) preparation of protocols and strategy for making contact, to inform potential participants about our research, and arrange meetings; (2) training of the research team, undergraduate students, and thesis students to conduct interviews; (3) applying and recording interviews with open questions related to the research topics; and (4) analysis of results by focus groups, workshops, and thesis direction. We also reviewed available municipal official records for 2009–2016, such as municipal annual public accounts, communality development plans, municipal internal regulations, budgetary data, and meeting minutes of municipal councils (Figure 5).

We systematically worked on the information during 2016–2021, obtained missing documentation by requesting complementary information from municipalities, ministries,

and public services, and triangulated different sources of information on the same matters of interest (Figure A12). For example, we collected information on investments through semi-structured interviews in the case-study municipalities, and from official data and consultations by correspondence, telephone, and active transparency. In order to complete the list of transfer agreements in the illustrative nine cases during 2009–2016, we first reviewed the list of agreements for each year available in the active transparency sections of the municipal websites, the municipal decrees of the same period, and registry of collaborators in the Ministry of Economy, complementing it with a detailed reading of the annual public accounts of the mayors, and validating the information produced with municipal officials (interviews, focus groups, and passive transparency).

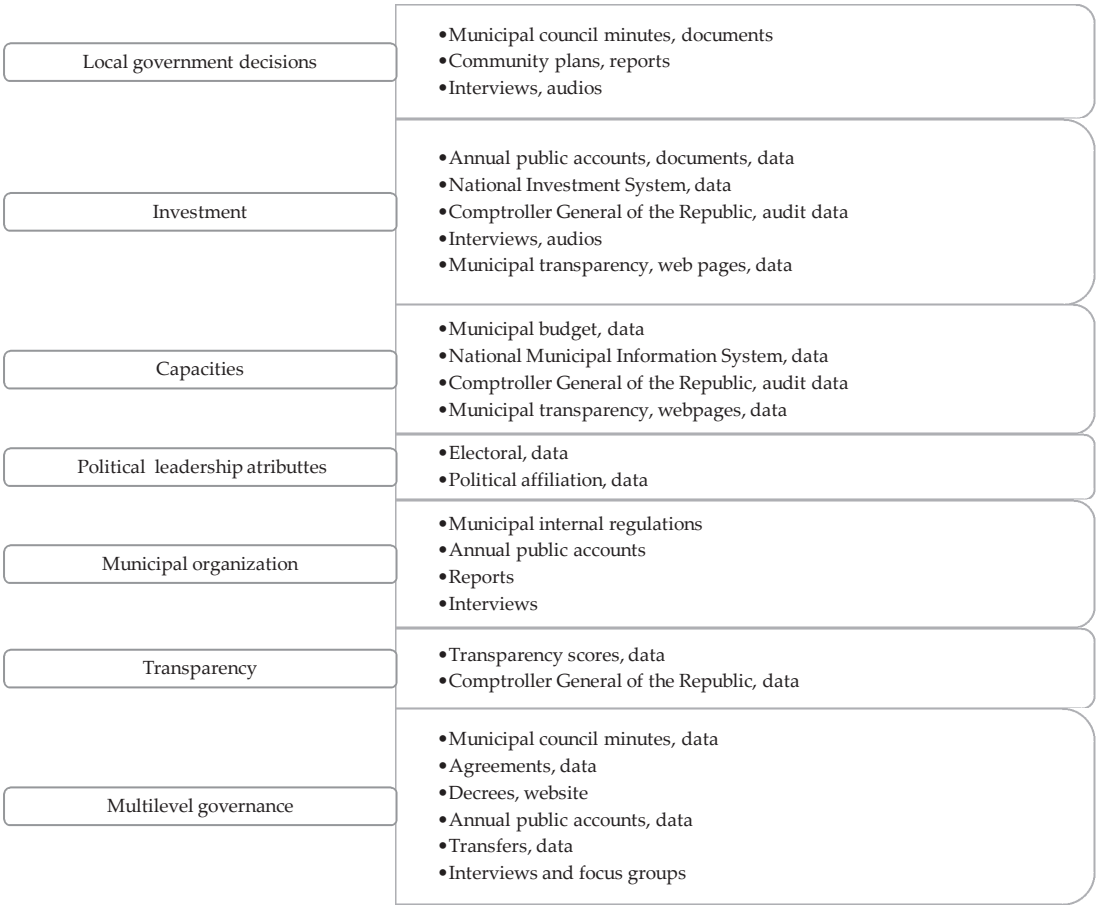


Figure A12. Concepts (latent) and triangulation of data (manifest variables).

Appendix E

Table A3. Effects of capacities, leadership, and accountability as moderator.

Variables	Model 1: Investment	Model 2: Maintenance
partFCM_rate	0.84614 ***	−118.346
medium (base: low) × partFCM_rate	−1.206.112	−5.64391 **
high (base: bajo) × partFCM_rate	0.3806593	−191.648
Pmarate	0.32313	199.059
medium (base: low) × pmarate	1.270.784	−435.189
high (base: low) × pmarate	1.643.535	−344.245
Perate	0.56664	341.424
medium (base: low) × perate	−1.574.757	−1.564.425
high (base: low) × perate	−4.497.749	−2.281.455
prof_muni_rate	−0.61795	4.77559 ***
medium (base: low) × prof_muni_rate	0.5767846	13.78759 ***
high (base: low) × prof_muni_rate	1.623.527	0.25064
edumayor (technical)	−307.692	2.317.893
medium (base: low) × edumayor	−8.723.003	−15.953.990
high (base: low) × edumayor	5.397.387	−2.402.755
edumayor (professional)	323.677	358.932
medium (base: low) × edumayor	−5.878.114	−4.888.378
high (base: low) × edumayor	3.552.982	−1.279.376
mayorvote_rate	0.34824	291.780
medium (base: low) × mayorvote_rate	4.85202 ***	−14.26488 ***
high (base: low) × mayorvote_rate	3.508.063	−12.90603 **
council_coalition	−0.404916**	−1.684582 **
medium (base: low) × council_coalition	−0.491772	1.998.828
high (base: low) × council_coalition	−0.71.5589	1.797.725
Rulingparty	18.42414 **	−1.286.452
medium (base: low) × rulingparty	−2.691.243	388.681
high (base: low) × rulingparty	1.343.677	6.652.708
Incumbent	14.46393 *	1.614.288
medium (base: low) × incumbent	4.585.507	10.859.117
high (base: low) × incumbent	2.184.817	5.999.462
iacm (Medium, base: Low)	1.148.032	−5.195.023
iacm (High, base: Low)	748.007	−8.665.127
orgm (Medium, base: Low)	340.030	9.709.894
orgm (High, base: Low)	4.274.493	8.664.163
transptotal_rate	−0.22212	−0.12968
Coastline	1.035.576	2.921.506
valley-mountain	239.633	−0.63852
Size	0.00450 **	−0.05334 ***
Rainfall	0.91262	0.06068
Temperature	−0.01673	0.36430
pover_rate	−0.07061	−0.52588
unemploy_rate	263.907	−1.104.613
ethnic_rate	1.43475 ***	4.88791 **
cap_region	1.405.354	0.00038
Density	−0.00118	0.000001
urb_rate	−0.47204 *	−2.91397 ***
num_eve_clim_hig	1.078.131	55.23354 **
num_eve_clim	−0.14427	−3.68663 **
earqk10_deaths	−0.21178	−142.251
earqk10_scale	816.027	−1.636.648
reported0814	−136.793	−431.245
no_illegal_settlements	1.842.745	−1.514.096
num_plantacontrata	−0.02152	0.11696

Table A3. *Cont.*

Variables	Model 1: Investment	Model 2: Maintenance
regional fixed effects	YES	YES
time fixed effects	YES	YES
RE (county)	YES	YES
adjusted Rho-squared	0.1996	0.2262
No of observations	1626	1454

* 10%, ** 5%, *** 1% significance level.

Table A4. Effects of capacities, leadership, and resource transfers as moderators.

Variables	Model 3: Investment	Model 4: Maintenance
partFCM_rate	0.95611 ***	−2.03521 *
interaction × partFCM_rate	0.00469	−0.14008 ***
Pmarate	−220.363	−1.157.431
interaction × pmarate	−0.07790	−0.49204 *
Perate	−0.21570	816.279
interaction × perate	2.080.444	0.35228 **
prof_muni_rate	−0.61014	4.38795 **
interaction × prof_muni_rate	−0.00315	0.12606 ***
edumayor (technical)	234.609	−1.615.647
interaction × edumayor	−0.842372	−0.20869
edumayor (professional)	−0.842372 ***	−2.322.270
interaction × edumayor	−1.214724 ***	−0.15584
mayorvote_rate	0.30316	4.21960 **
interaction × mayorvote_rate	−0.01622 *	0.02872
council_coalition	−0.529106 ***	−1.577342 **
interaction × council_coalition	−0.010583 ***	−0.357629 **
Rulingparty	16.70460 **	−2.807.512
interaction × rulingparty	−0.2678327	−1.91807 ***
Incumbent	22.44683 ***	2.661.684
interaction × incumbent	1.113316 ***	3.38906 ***
Subdemanagtranshab	1.15707 *	−0.59521
Subdeinvesttranshab	−0.44622	212.849
gastranscor_reghab	−0.00109	−0.09284
horizontal_networkhab	0.00005	0.00006
Coastline	645.979	1.998.859
valley-mountain	416.873	2.590.524
Size	0.00574 ***	−0.05255 ***
Rainfall	−0.01310	0.04569
Temperature	0.86191	−0.22025
pover_rate	−0.11429	0.07495
unemploy_rate	3.58730 *	−554.504
ethnic_rate	1.53013 ***	3.98765 **
cap_region	624.880	5.184.679
Density	−0.00218	0.00232
urb_rate	−0.34390	−2.50651 **
num_eve_clim_hig	12.29390 **	53.92427 **
num_eve_clim	−0.23489	−2.67605*
earqk10_deaths	−0.01089	−0.87266
earqk10_scale	811.540	−442.482
reported0814	0.36276	−495.383
no_illegal_settlements	1.491.111	−780.230
num_plantacontrata	−0.22450	0.35171
regional fixed effects	YES	YES
time fixed effects	YES	YES
RE (comuna)	YES	YES
adjusted Rho-squared	0.2349	0.2543
No of observations	1.626	1454

* 10%, ** 5%, *** 1% significance level.

Table A5. Effects of capacities, leadership, and municipal organization as moderators.

Variables	Model 5: Investment	Model 6: Maintenance
partFCM_rate	0.82661 ***	−113.760
medium (base: low) × partFCM_rate	−0.6967037	−329.817
high (base: bajo) × partFCM_rate	8.48499 ***	−304.874
Pmarate	204.944	548.559
medium (base: low) × pmarate	3.332.897	−324.323
high (base: low) × pmarate	6.094.854	9.077.675
Perate	0.81822	368.485
medium (base: low) × perate	−7.453.823	−1.558.892
high (base: low) x perate	−1.712.324	−1.353.712
prof_muni_rate	−0.55399	5.51509 ***
medium (base: low) × prof_muni_rate	1.167.583	9.28556 **
high (base: low) × prof_muni_rate	−4.114.763	−252.113
edumayor (technical)	180.420	1.881.865
medium (base: low) × edumayor	−2.750.327	−6.866.637
high (base: low) × edumayor	1.380.645	−2.413.567
edumayor (professional)	563.107	−482.699
medium (base: low) × edumayor	−3.258.027	−4.949.822
high (base: low) × edumayor	128.997	−17.148.606
mayorvote_rate	1.09634 **	306.746
medium (base: low) × mayorvote_rate	1.710.782	−10.71454 **
high (base: low) × mayorvote_rate	38.26841 ***	−1.101.569
council_coalition	−0.270838	−1.428652 *
medium (base: low) × council_coalition	−0.818493	2.230.169
high (base: low) × council_coalition	2.661.787	1.899.637
Rulingparty	19.94061 ***	−1.530.918
medium (base: low) × rulingparty	9.328.835	967.592
high (base: low) × rulingparty	7.984.552	371.413
Incumbent	16.36236 **	720.539
medium (base: low) × incumbent	5.697.539	4.573.341
high (base: low) × incumbent	−9.170.789	1.853.434
iacm (medium, base: Low)	−1.001.691	−7.391.593
iacm (high, base: Low)	−1.803.071	−12.163.967
orgm (medium, base: Low)	2.447.997	12.542.401
orgm (high, base: Low)	150.37013 ***	13.761.530
transptotal_rate	−0.15831	−0.07838
Coastline	1.331.887	519.391
valley-mountain	717.044	339.381
Size	0.00505 ***	−0.05719 ***
Rainfall	−0.01630	0.05507
Temperature	114.045	166.029
pover_rate	0.32793	−0.58197
unemploy_rate	229.028	−879.040
ethnic_rate	1.26995 ***	4.93559 **
cap_region	760.688	4.652.036
Density	−0.00131	0.00653
urb_rate	−0.39979	−2.82187 **
num_eve_clim_hig	13.23202 *	62.62578 **
num_eve_clim	−0.30934	−2.78529 *
earqk10_deaths	−0.23281	−159.552
earqk10_scale	647.751	−768.231
reported0814	−244.646	−678.367
no_illegal_settlements	932.760	−2.232.422
num_plantacontrata	−0.02611	−0.08732
regional fixed effects	YES	YES
time fixed effects	YES	YES
RE (comuna)	YES	YES
adjusted Rho-squared	0.2205	0.2174
No of observations	1626	1454

* 10%, ** 5%, *** 1% significance level.

References

1. Betsill, M. Mitigating climate change in US cities. *Local Environ.* **2001**, *6*, 393–406. [CrossRef]
2. Carmin, J.; Anguelovski, I.; Roberts, D. Urban climate adaptation in the Global South. *J. Plan. Educ. Res.* **2012**, *32*, 18–32. [CrossRef]
3. Valdivieso, P.; Andersson, K.P.; Villena–Roldán, B. Institutional drivers of adaptation in local government decision–making. *Clim. Chang.* **2017**, *143*, 151–171. Available online: https://static--content.springer.com/esm/art%3A10.1007%2Fs10584--017--1961--9/MediaObjects/10584_2017_1961_MOESM1_ESM.pdf (accessed on 20 December 2018). [CrossRef]
4. Valdivieso, P.; Andersson, K.P. What Motivates Local Governments to Invest in Critical Infrastructure? Lessons from Chile. *Sustainability* **2018**, *10*, 3808. [CrossRef]
5. Bernauer, T. Climate Change Politics. *Annu. Rev. Polit. Sci.* **2013**, *16*, 421–448. [CrossRef]
6. Organisation for Economic Co–Operation and Development. *Good Governance for Critical Infrastructure Resilience*; OECD: Paris, France, 2019.
7. Carleton, T.A.; Hsiang, S.M. Social and economic impacts of climate. *Science* **2016**, *353*, aad9837. [CrossRef] [PubMed]
8. Intergovernmental Panel on Climate Change. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*; Special Report; Cambridge University Press: Cambridge, UK, 2012.
9. McGee, S.; Frittman, J.; Seongjin, J.A.; Murray, S. *Risk Relationships and Cascading Effects in Critical Infrastructures: Implications for the Hyogo Framework*; United Nations International Strategy for Disaster Reduction: Geneva, Switzerland, 2014.
10. Forzieri, G.; Bianchi, A.; Batista, F.; Marin, M.; Leblois, A.; Lavalle, C.; Aerts, J.; Feyen, L. Escalating impacts of climate extremes on critical infrastructures in Europe. *Glob. Environ. Chang.* **2018**, *48*, 97–107. [CrossRef] [PubMed]
11. Huskova, I.; Matrosov, E.; Harou, J.; Kasprzyk, J.; Lambert, C. Screening robust water infrastructure investments and their trade–offs under global change: A London example. *Glob. Environ. Chang.* **2016**, *41*, 216–227. [CrossRef]
12. Organisation for Economic Co–Operation and Development. *Climate–Resilient Infrastructure*; OECD: Paris, France, 2018.
13. Revi, A.; Satterthwaite, D.E.; Aragón–Durand, F.; Corfee-Morlot, J.; Kiunsi, R.B.R.; Pelling, M.; Roberts, D.C.; Solecki, W. Urban areas. In *Climate Change*; Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Genova, R.C., et al., Eds.; Cambridge University Press: Cambridge, UK, 2014; pp. 538–541, 546, 552, 563–575, 577.
14. Fay, M.; Atsushi, I.; Perrissin–Fabert, B. *Financing Greener and Climate–Resilient Infrastructure in Developing Countries*; Atsushi, I., Perrissin–Fabert, B., Eds.; European Investment Bank (EIB): Luxembourg, 2010.
15. Inter–American Development Bank. *Policy Evaluation Framework on the Governance of Critical Infrastructure Resilience in Latin America*; Inter–American Development Bank: Washington, DC, USA, 2017.
16. Valdivieso, P. Institutional analysis on the governance of disaster risk reduction at the local level. Analysis with Chilean municipalities. In *Multiscale, Regional, and Local Planning*; Cuervo, L., Délano, M., Eds.; United Nations Economic Commission for Latin America and the Caribbean (CEPAL): Santiago, Chile, 2019; pp. 233–255. Available online: https://repositorio.cepal.org/handle/11362/44845 (accessed on 11 July 2021). (In Spanish)
17. Ostrom, E. *Understanding Institutional Diversity*; Princeton University Press: Princeton, NJ, USA, 2005.
18. Funder, M.; Mweemba, C.M. Interface bureaucrats and the everyday remaking of climate interventions: Evidence from climate change adaptation in Zambia. *Glob. Environ. Chang.* **2019**, *55*, 130–138. [CrossRef]
19. Hardin, R. Collective Action as an Agreeable n–Prisoners' Dilemma. *Science* **1971**, *16*, 472–481. [CrossRef]
20. Haynes, K.; Yoder, K. Offsetting Uncertainty: Reassurance with Two-Sided Incomplete Information. *Am. J. Political Sci.* **2020**, *64*, 38–51. [CrossRef]
21. Coleman, E.; Mwangi, E. Conflict, Cooperation, and Institutional Change on the Commons. *Am. J. Political Sci.* **2015**, *59*, 855–865. [CrossRef]
22. Downs, A. *Inside Bureaucracy*; Little Brown: Boston, MA, USA, 1967; pp. 2, 25.
23. Duvat, V.K.E.; Volto, N.; Stahl, L.; Moatty, A.; Defossez, S.; Desarthe, J.; Grancher, D.; Pillet, V. Understanding interlinkages between long-term trajectory of exposure and vulnerability, path dependency and cascading impacts of disasters in Saint-Martin (Caribbean). *Glob. Environ. Chang.* **2021**, *67*. [CrossRef]
24. Bhavnani, R.; Lee, A. Does Affirmative Action Worsen Bureaucratic Performance? Evidence from the Indian Administrative Service. *Am. J. Political Sci.* **2021**, *65*, 5–20. [CrossRef]
25. Velasco, C. Loyalty or Incentives? How Party Alignment Affects Bureaucratic Performance. *J. Politics* **2020**, *82*, 1287–1304.
26. Stark, A.; Head, B. Institutional amnesia and public policy. *J. Eur. Public Policy* **2019**, *26*, 1521–1539. [CrossRef]
27. Ostrom, E. *Governing the Commons: The Evolution of Institutions for Collective Action*; Cambridge University Press: New York, NY, USA, 1990.
28. Ostrom, E. Collective Action and the Evolution of Social Norms. *J. Econ. Perspect.* **2000**, *14*, 137–158. [CrossRef]
29. Hayhoe, K.; Robson, M.; Rogula, J.; Auffhammer, M.; Miller, N.; Van Dorn, J.; Wuebbles, D. An integrat-ed framework for quantifying and valuing climate change impacts on urban energy and infrastructure: A Chicago case study. *J. Great Lakes Res.* **2010**, *36*, 94–105. [CrossRef]
30. Schmidt, N.; Meyer, M.D. Incorporating Climate Change Considerations into Transportation Planning. *Transp. Res. Rec.* **2009**, *2119*, 66–73. [CrossRef]
31. Innes, J.E.; Booher, D.E. Consensus building and complex adaptive systems: A framework for evaluating collaborative planning. *J. Am. Plan. Assoc.* **1999**, *65*, 412–423. [CrossRef]
32. Berke, P.R.; Campanella, T.J. Planning for postdisaster resiliency. *Ann. Am. Acad. Political Soc. Sci.* **2006**, *604*, 192–207. [CrossRef]

33. Simpson, D.M.; Rockaway, T.D.; Weigel, T.A.; Coomes, P.A.; Holloman, C.O. Framing a new approach to critical infrastructure modelling and extreme events. *Int. J. Crit. Infrastruct.* **2005**, *1*, 125–143. [CrossRef]
34. Aylett, A. Institutionalizing the urban governance of climate change adaptation: Results of an international survey. *Urban Clim.* **2015**, *14*, 4–16. [CrossRef]
35. Lesnikowski, A.; Biesbroek, R.; Ford, J.D.; Berrang-Ford. Policy implementation styles and local governments: The case of climate change adaptation. *Environ. Politics* **2020**. [CrossRef]
36. Cashmore, M.; Wejs, A. Constructing legitimacy for climate change planning: A study of local government in Denmark. *Glob. Environ. Chang.* **2014**, *24*, 203–212. [CrossRef]
37. Kousser, T.; Tranter, B. The influence of political leaders on climate change attitudes. *Glob. Environ. Chang.* **2018**, *50*, 100–109. [CrossRef]
38. Williams, D.S.; Celliers, L.; Unverzagt, K.; Videira, N.; Máñez Costa, M.; Giordano, R.A. A method for enhancing capacity of local governance for climate change adaptation. *Earth's Future* **2020**, *8*, e2020EF001506. [CrossRef]
39. Friedrich, R. In Defense of Multiplicative Terms in Multiple Regression Equations. *Am. J. Political Sci.* **1982**, *26*, 797–833. [CrossRef]
40. Wooldridge, J.M. Control function methods in applied econometrics. *J. Hum. Resour.* **2015**, *50*, 420–445. [CrossRef]
41. Nitzl, C.; Hilgers, D.; Hirsch, B.; Lindermüller, D. The Influence of the Organizational Structure, Environment, and Resource Provision on the Use of Accrual Accounting in Municipalities. *Schmalenbach Bus Rev.* **2020**, *72*, 271–298. [CrossRef]
42. Bulkeley, H.; Betsill, M. Revisiting the urban politics of climate change. *Environ. Polit* **2013**, *22*, 136–154. [CrossRef]
43. Bulkeley, H.; Betsill, M. *Cities and Climate Change: Urban Sustainability and Global Environmental Governance*; Routledge: Oxon, NY, USA, 2003.
44. Park, A.; Krause, R.; Hawkins, C. Institutional Mechanisms for Local Sustainability Collaboration: Assessing the Duality of Formal and Informal Mechanisms in Promoting Collaborative Processes. *J. Public Adm. Res. Theory* **2021**, *31*, 434–450. [CrossRef]
45. IDEchile. *Geospatial Data Infrastructure*; Ministerio de Bienes Nacionales: Santiago, Chile, 2021; Available online: https://www.ide.cl/index.php (accessed on 21 June 2018). (In Spanish)
46. Geographic Military Institute. *Maps of Chile*; Instituto Geográfico Militar: Santiago, Chile, 2021; Available online: https://www.igm.cl/ (accessed on 21 June 2018). (In Spanish)
47. National Institute Statistics. *Statistics, Databases*; Instituto Nacional de Estadísticas: Santiago, Chile, 2021; Available online: https://www.ine.cl/estadisticas (accessed on 21 August 2018). (In Spanish)
48. Undersecretary of Regional and Administrative Development. *National Municipal Information System*; Subsecretaría de Desarrollo Regional Administrativo: Santiago, Chile, 2021; Available online: http://www.sinim.cl/ (accessed on 21 July 2018). (In Spanish)
49. Library of Congress of Chile. Chilean Constitution; Chilean Congress; Valparaíso, Chile. 2021. Available online: https://www.bcn.cl/ (accessed on 21 April 2018). (In Spanish).
50. Library of Congress. *Constitutional Law No. 18.695 of Municipalities*; Library of Congress: Valparaíso, Chile, 2021; Available online: https://www.bcn.cl/leychile/navegar?idNorma=251693 (accessed on 27 December 2020). (In Spanish)
51. Organisation for Economic Co–Operation and Development. *Making Decentralisation Work in Chile*; OECD: Paris, France, 2017.
52. Ministry of Housing and Urban Development. *Quality of Life Surveys; Databases (2007, 2010, 2012, 2015)*; Ministry of Housing and Urban Development: Santiago, Chile, 2021. Available online: https://calidaddevida.minvu.gob.cl/documentos--encuesta--de--percepcion--de--calidad--de--vida--urbana (accessed on 28 June 2020). (In Spanish)
53. Ministry of Social Development. *Socioeconomic Characterization Surveys; Databases (2009, 2011, 2013, 2015)*; Ministry of Social Development: Santiago, Chile, 2021; Available online: http://observatorio.ministeriodesarrollosocial.gob.cl/ (accessed on 28 September 2020). (In Spanish)
54. Valdivieso, P.; Andersson, K.P. Local politics of environmental disaster risk management: Institutional analysis and lessons from Chile. *J. Environ. Dev.* **2017**, *26*, 51–81. [CrossRef]
55. Valdivieso, P. Municipal governance, environmental management and disaster risk reduction in Chile. *Bull. Lat. Am. Res.* **2017**, *36*, 440–458. [CrossRef]
56. National Fund for Scientific and Technological Research. *Institutional Drivers of Local Environmental Management in Chile; FONDECYT Grant 1181282*; Universidad Austral: Valdivia, Chile, 2021; Available online: https://sites.google.com/view/localenvironmentalgovernance/home) (accessed on 22 November 2020). (In Spanish)
57. Ministry of Public Works. *Road Network and Distances*; Ministerio de Obras Públicas, Dirección de Vialidad: Santiago, Chile, 2021; Available online: http://www.vialidad.cl/productosyservicios/Paginas/Distancias.aspx (accessed on 22 May 2018). (In Spanish)
58. Balbontín, R.; Escobar, L.; Seemann, A. *Financing of Regional Governments in Chile*; Dirección de Presupuesto: Santiago, Chile, 2017; Available online: https://www.dipres.gob.cl/598/articles-160346_doc_pdf.pdf (accessed on 29 July 2018). (In Spanish)
59. Ministry of Environment. *Chile´s Second Biennial Update Report to the United Framework Convention on Climate Change*; Ministry of Environment: Santiago, Chile, 2016; Available online: https://unfccc.int/resource/docs/natc/chinc2e.pdf (accessed on 4 April 2018). (In Spanish)
60. Organisation for Economic Co–Operation and Development. *Gaps and Governance Standards of Public Infrastructure in Chile: Infrastructure Governance Review*; OECD: Paris, France, 2017.
61. Valdivieso, P. Institutional and social enablers for governance of environmental risks at the local scale. Analysis with Chilean municipalities. *Opinião Pública* **2017**, *23*, 538–573. [CrossRef]

62. Organisation for Economic Co–Operation and Development/Economic Commission for Latin America and the Caribbean. *OECD Environmental Performance Reviews: Chile 2016*; OECD: Paris, France, 2016.
63. Meteored. *Climate Information*; Meteored: Santiago, Chile, 2018; Available online: https://www.meteored.cl/ (accessed on 29 April 2018). (In Spanish)
64. Educar Chile. *Climate Map of Chile*; Ministerio de Educación, Fundación Chile: Santiago, Chile, 2018; Available online: http://www.educarchile.cl/ech/pro/app/detalle?id=130965 (accessed on 2 May 2018). (In Spanish)
65. Organisation for Economic Co–Operation and Development/Economic Commission for Latin America and the Caribbean. *OECD Environmental Performance Reviews: Chile 2005*; OECD: Paris, France, 2005.
66. Ministry Environment. *National Surveys on Environment (2014, 2015, 2016)*; Ministry Environment: Santiago, Chile, 2021; Available online: https://mma.gob.cl/encuestas-nacionales-del-medio-ambiente (accessed on 29 September 2020). (In Spanish)
67. Economic Commission for Latin America and the Caribbean. *The Economy of climate change in Latin America*; Economic Commission for Latin America and the Caribbean: Santiago, Chile, 2015. (In Spanish)
68. United States Geological Survey (USGS) Earthquake Hazards Program; Department of the Interior: Washington, DC, USA. 2018. Available online: http://earthquake.usgs.gov/ (accessed on 22 July 2018). (In Spanish)
69. National Forest Corporation. *Forest Fires*; Corporación Forestal Nacional, Ministry of Agriculture: Santiago, Chile, 2021; Available online: https://www.conaf.cl/incendios--forestales/ (accessed on 20 July 2020). (In Spanish)
70. National Aeronautics and Space Administration (NASA). *Earth Observatory*; National Aeronautics and Space Administration: Washington, DC, USA, 2018. Available online: https://earthobservatory.nasa.gov/about (accessed on 17 July 2020). (In Spanish)
71. *Centre for Research on the Epidemiology of Disasters (CRED) Annual Disaster STATISTICAL Review*; Centre for Research on the Epidemiology of Disasters: Louvain–la–Neuve, Belgium, 2011.
72. Alliance Development Works. *World Risk Report 2015*; United Nations University, Institute for Environment and Human Security: Bonn, Germany; Available online: http://collections.unu.edu/collection/UNU:1901 (accessed on 15 July 2018). (In Spanish)
73. National Seismological Center. *Latest Earthquake*; Universidad de Chile: Santiago, Chile, 2015; Available online: http://www.sismologia.cl/ (accessed on 10 July 2018). (In Spanish)
74. National Oceanic and Atmospheric Administration (NOAA). *National Environmental Satellite Data and Information Service*; National Oceanic and Atmospheric Administration: Washington, DC, USA, 2018. Available online: https://www.ospo.noaa.gov/Organization/About/contact.html (accessed on 9 July 2018). (In Spanish)
75. National Geology and Mining Service. Volcanic Hazards; Servicio Nacional de Geología y Minería, Santiago, Chile. 2018. Available online: http://www.sernageomin.cl/archivos/PeligrosVolcanicosdeChile.pdf (accessed on 2 July 2018). (In Spanish).
76. United Nations International Strategy for Disaster Reduction. *DesInventar*; United Nations International Strategy for Disaster Reduction: Geneva, Switzerland, 2018; Available online: https://www.desinventar.net/ (accessed on 27 July 2018). (In Spanish)
77. World Bank. *Country Note on Climate Change Aspects in Agriculture*; World Bank: New York, NY, USA, 2009.
78. National Emergency Office. *National Policy for Disaster Risk Reduction*; Oficina Nacional de Emergencia (ONEMI): Santiago, Chile, 2014. Available online: https://www.onemi.gov.cl/planes-nacionales/ (accessed on 22 April 2018). (In Spanish)
79. Nahuelpan, E.; Varas, J. *The Earthquake in Chile: Medico–Legal Statistics*; Instituto Médico Legal: Santiago, Chile, 2013; Available online: http://icy.sml.gob.cl/wp-content/uploads/2020/01/Revista-Investigacion-Forense-Numero-2.pdf (accessed on 22 November 2018). (In Spanish)
80. Ministry of Interior. *Earthquake and Tsunami Reconstruction Plan*; Ministerio del Interior: Santiago, Chile, 2010; Available online: https://www.preventionweb.net/files/28726_plandereconstruccinagosto2010.pdf (accessed on 22 November 2018). (In Spanish)
81. Astroza, M.; Ruiz, S.; Astroza, R.; Molina, J. *Seismic Intensities 2010*; Universidad de Chile: Santiago, Chile, 2014; Available online: http://dgf.uchile.cl/~{}sruiz/Papers/books/107-126.pdf (accessed on 25 May 2020). (In Spanish)
82. Ministry of Social Development. *Integrated Projects Bank*; Ministerio de Desarrollo Social: Santiago, Chile, 2021; Available online: https://bip.ministeriodesarrollosocial.gob.cl/bip2-trabajo/app/login (accessed on 25 September 2020). (In Spanish)
83. National Emergency Office. *Underlying Risk Factors*; Oficina Nacional de Emergencia: Santiago, Chile, 2014; Available online: https://geoportalonemi.maps.arcgis.com/apps/MapSeries/index.html?appid=a6775bda6d054305a2482efc999d9890 (accessed on 22 April 2018). (In Spanish)
84. Satterthwaite, D.; Huq, S.; Pelling, M.; Reid, H.; Romero Lankao, P. *Adapting to Climate Change in Urban Areas*; International Institute for Environment and Development (IIED): London, UK, 2007.
85. Organisation for Economic Co–Operation and Development. *Investing in Climate, Investing in Growth*; OECD: Paris, France, 2017.
86. Ostrom, E.; Schroeder, L.; Wynne, S. *Institutional Incentives and Sustainable Development: Infrastructure Policies in Perspective*; Westview Press: Boulder, CO, USA, 1993.
87. Ostrom, V.; Ostrom, E. Public Choice: A Different Approach to the Study of Public Administration. *Public Adm. Rev.* **1971**, *31*, 203–216. [CrossRef]
88. LSE Cities, UN–Habitat. *How Cities are Governed: Building a Global Database for Current Models of Urban Governance*; London School of Economics and Political Science: London, UK, 2016; Available online: https://urbangovernance.net/en/ (accessed on 22 January 2020). (In Spanish)
89. Roberts, D. Prioritizing climate change adaptation and local level resilience in Durban, South Africa. *Environ. Urban.* **2010**, *22*, 397–413. [CrossRef]

90. Aylett, A. The Socio–institutional Dynamics of Urban Climate Governance: A Comparative Analysis of Innovation and Change in Durban (KZN, South Africa) and Portland (OR, USA). *Urban Stud.* **2013**, *50*, 1386–1402. [CrossRef]
91. Sánchez-Rodríguez, R. Learning to adapt to climate change in urban areas. A review of recent contributions. *Curr. Opin. Environ. Sustain.* **2009**, *1*, 201–206. [CrossRef]
92. Nuno, F.; Rode, P.; McQuarrie, M. New urban governance: A review of current themes and future priorities. *J. Urban Aff.* **2018**, *41*, 1–19.
93. Bakera, I.; Peterson, A.; Brown, G.; McAlpinea, C. Local government response to the impacts of climate change: An evaluation of local climate adaptation plans. *Urban Plan.* **2012**, *107*, 127–136. [CrossRef]
94. Kiunsi, R. The constraints on climate change adaptation in a city with a large development deficit: The case of Dar es Salaam. *Environ. Urban.* **2013**, *25*, 321–337. [CrossRef]
95. Quiroz, D. Las ciudades y el cambio climático: El caso de la política climática de la Ciudad de México. *Estud. Demográficos Urbanos.* **2013**, *28*, 343–382. [CrossRef]
96. Groven, K.; Aall, C.; van den Berg, M.; Carlsson–Kanyama, A.; Coenen, F. Integrating climate change adaptation into civil protection: Comparative lessons from Norway, Sweden and the Netherlands. *Local Envron. Int. J. Justice Sustain.* **2012**, *17*, 679–694. [CrossRef]
97. Burby, R.; Deyle, R.; Godschalk, D.; Olshansky, R. Creating hazard resilient communities through land–use planning. *Nat. Hazards Rev.* **2000**, *1*, 99–106. [CrossRef]
98. Jensen, A.; Nielsen, H.; Nielsen, M. *Climate Adaptation in Local Governance: Institutional Barriers in Danish Municipalities*; Arhus University, DCE—Danish Centre for Environment and Energy: Aarhus, Denmark, 2016; Available online: http://dce2.au.dk/pub/SR104.pdf (accessed on 20 February 2020). (In Spanish)
99. Tullock, G. *The Politics of Bureaucracy*; Public Affairs Press: Washington, DC, USA, 1965; p. 69.
100. Wheeler, S.M. State and municipal climate change plans: The first generation. *J. Am. Plan Assoc.* **2008**, *74*, 481–496. [CrossRef]
101. Bridget, K. Local Bureaucrats and Climate Change Adaptation; Siracuse University, New York, NY, USA. 2018. Available online: https://surface.syr.edu/etd/895 (accessed on 23 June 2021). (In Spanish).
102. Lavee, E.; Cohen, N. How street-level bureaucrats become policy entrepreneurs: The case of urban renewal. *Governance* **2019**, *32*, 475–492. [CrossRef]
103. Dahl, R. *Who Governs? Democracy and Power in an American City*; Yale University Press: New Haven, CT, USA, 1961.
104. Liefferink, D.; Wurzel, R.K.W. Environmental leaders and pioneers: Agents of change? *J. Eur. Public Policy* **2017**, *24*, 951–968. [CrossRef]
105. De la Porte, C.; Natali, D. Agents of institutional change in EU policy: The social investment moment. *J. Eur. Public Policy* **2018**, *25*, 828–843. [CrossRef]
106. Graen, G.B. Overview of future research directions for team leadership. In *The Oxford Handbook of Leadership*; Rumsey, M., Ed.; Oxford University Press: New York, NY, USA, 2013; pp. 167–183.
107. Blau, J.R.; Alba, R.D. Empowering nets of participation. *Adm. Sci. Q.* **1982**, *27*, 363–379. [CrossRef]
108. Balkundi, P.; Kilduff, M. The ties that lead: A social network approach to leadership. *Leadersh. Q.* **2005**, *16*, 419–439. [CrossRef]
109. Bell, S. Do we really need a new "constructivist institutionalism" to explain institutional change? *Br. J. Polit. Sci.* **2011**, *41*, 883–906. [CrossRef]
110. Bhavnani, R.; Lee, A. Local Embeddedness and Bureaucratic Performance: Evidence from India. *J. Politics* **2018**, *80*, 71–87. [CrossRef]
111. Taylor, A.; Cocklin, C.; Brown, R.; Wilson–Evered, E. An investigation of champion–driven leadership processes. *Lead. Q.* **2011**, *22*, 412–433. [CrossRef]
112. Li, X.; Han, M.; Cohen, G.L.; Markus, H.R. Passion matters but not equally everywhere: Predicting achievement from interest, enjoyment, and efficacy in 59 societies. *PNAS* **2021**, *118*, e2016964118. [CrossRef] [PubMed]
113. Szreter, S.; Woolcock, M. Health by association? Social capital, social theory, and the political economy of public health. *Int. J. Epidemiol.* **2004**, *33*, 650–667. [CrossRef]
114. Palermo, V.; Bertoldi, P.; Apostolou, M.; Kona, A.; Rivas, S. Assessment of climate change mitigation policies in 315 cities in the Covenant of Mayors initiative. *Sustain. Cities Soc.* **2020**, *60*, 102258. [CrossRef]
115. Bentzen, T.; Lo, C.; Winsvold, M. Strengthening local political leadership through institutional design: How and why. *Local Gov. Stud.* **2020**, *46*, 483–504. [CrossRef]
116. Walkowiak, K.; Bernaciak, A. Leadership Styles of Rural Leaders in the Context of Sustainable Development Requirements: A Case Study of Commune Mayors in the Greater Poland Province, Poland. *Sustainability* **2020**, *12*, 2676. [CrossRef]
117. Granberg, M.; Bosomworth, K.; Moloney, S.; Kristianssen, A.-C.; Fünfgeld, H. Can Regional-Scale Governance and Planning Support Transformative Adaptation? A Study of Two Places. *Sustainability* **2019**, *11*, 6978. [CrossRef]
118. Heinelt, H. The Changing Context of Local Democracy. In *Role Perception and Behaviour of Municipal Councillors*; Routledge: Oxfordshire, UK, 2020.
119. Greenwood, R.; Suddaby, R. Institutional entrepreneurship in mature fields: The big five accounting firms. *Acad. Manag. J.* **2006**, *49*, 27–48. [CrossRef]
120. Schotter, A.P.J.; Meyer, K.; Wood, G. Organizational and comparative institutionalism in international HRM: Toward an integrative research agenda. *Hum. Resour. Manage.* **2021**, *60*, 205–227. [CrossRef]

121. March, J.G.; Olsen, J.P. Ambiguity and Choice in Organizations. *Am. Political Sci. Rev.* **1976**, *78*, 734–749.
122. Meyer, J.W.; Rowan, B. Institutionalized Organizations: Formal Structure as Myth and Ceremony. *Am. J. Sociol.* **1977**, *83*, 440–463. [CrossRef]
123. Ruef, M.; Richard, S.A. Multidimensional Model of Organizational Legitimacy: Hospital Survival in Changing Institutional Environments. *Adm. Sci. Q.* **1998**, *43*, 877–904. [CrossRef]
124. Dacin, T.; Goldstein, J.; Scott, W.R. Institutional theory and institutional change: Introduction to the special research forum. *Acad. Manag. J.* **2002**, *45*, 45–56. [CrossRef]
125. Foster, J.; Jones, J. Rule Orientation and Bureaucratic Reform. *Am. J. Political Sci.* **1978**, *22*, 348–363. [CrossRef]
126. Wilson, J.Q. *Bureaucracy: What Government Agencies Do and Why They Do It*; Basic Books: New York, NY, USA, 1989.
127. Kruis, J.; Maris, G.; Marsman, M.; Bolsinova, M.; Van der Maas, H. Deviations of rational choice: An integrative explanation of the endowment and several context effects. *Sci. Rep.* **2020**, *10*, 16226. [CrossRef] [PubMed]
128. Lapuente, V.; Suzuki, K. Politicization. Bureaucratic Legalism, and Innovative Attitudes in the Public Sector. *Public Admin. Rev.* **2020**, *80*, 454–467. [CrossRef]
129. Scott, I.; Gong, T. Coordinating government silos: Challenges and opportunities. *GPPG* **2021**, *1*, 20–38. [CrossRef]
130. Agrawal, A.; Ribot, J. Accountability in decentralization. *J. Dev. Areas* **1999**, *33*, 473–502.
131. Heimstädt, M.; Dobusch, L. Transparency and Accountability: Causal, Critical and Constructive Perspectives. *Organ. Theory* **2020**. [CrossRef]
132. Birkmann, J.; Garschagen, M.; Kraas, F.; Quang, N. Adaptive urban governance: New challenges for the second generation of urban adaptation strategies to climate change. *Sustain. Sci.* **2010**, *5*, 185–206. [CrossRef]
133. Bae, J.; Feiock, R. Forms of Government and Climate Change Policies in US Cities. *Urban Stud.* **2013**, *50*, 776–788. [CrossRef]
134. Solecki, W.; Rosenzweig, C. Indicators and monitoring systems for urban climate resiliency. *Clim. Chang.* **2020**, *163*, 1815–1837. [CrossRef]
135. Weber, M. *Economy and Society*; Bedminster Press: New York, NY, USA, 1968.
136. Sorensen, A. Public Norms and Aspirations: The Turn to Institutions in Action. *Plan. Theory Pract.* **2020**, *21*, 808–811. [CrossRef]
137. DiMaggio, P.J.; Powell, W.W. *The New Institutionalism in Organizational Analysis*; University of Chicago Press: Chicago, IL, USA, 1991.
138. Hallett, T.; Hawbaker, A. The case for an inhabited institutionalism in organizational research: Interaction, coupling, and change reconsidered. *Theor. Soc.* **2021**, *50*, 1–32. [CrossRef]
139. Seo, M.G.; Creed, W.E.D. Institutional contradictions, praxis and institutional change: A dialectical perspective. *Acad. Manag. Rev.* **2002**, *27*, 222–247. [CrossRef]
140. West, W. Structuring Administrative Discretion: The Pursuit of Rationality and Responsiveness. *Am. J. Political Sci.* **1984**, *28*, 340–360. [CrossRef]
141. Stein, R. Municipal Public Employment: An Examination of Intergovernmental Influences. *Am. J. Political Sci.* **1984**, *28*, 636–653. [CrossRef]
142. March, C. Exploration and Exploitation in Organizational Learning. *Organ. Sci.* **1991**, *2*, 71–87. [CrossRef]
143. Tilman, A.R.; Plotkin, J.B.; Akçay, E. Evolutionary games with environmental feedbacks. *Nat. Commun.* **2020**, *11*, 915. [CrossRef]
144. Sommerer, T.; Tallberg, J. Diffusion Across International Organizations: Connectivity and Convergence. *Int. Organ.* **2019**, *73*, 399–433. [CrossRef]
145. Ostrom, V.; Tiebout, C.; Warren, R. The Organization of Government in Metropolitan Areas: A Theoretical Inquiry. *Am. Political Sci. Rev.* **1961**, *55*, 831–842. [CrossRef]
146. Hooghe, L.; Marks, G.A. A postfunctionalist theory of multilevel governance. *Br. J. Politics Int. Relat.* **2020**, *22*, 820–826. [CrossRef]
147. Gupta, J.; Lasage, R.; Stam, T. National efforts to enhance local climate policy in the Netherlands. *Environ. Sci.* **2007**, *4*, 171–182. [CrossRef]
148. Urwin, K.; Jordan, A. Does public policy support or undermine climate change adaptation? Exploring policy interplay across different scales of governance. *Glob. Environ. Chang.* **2008**, *18*, 180–191. [CrossRef]
149. Di Gregorio, M.; Fatorelli, L.; Paavola, J.; Locatelli, B.; Pramova, E.; Nurrochmat, D.R.; May, P.H.; Brockhaus, M.; Maya, I.; Dyah, S. Multi–level governance and power in climate change policy networks. *Glob. Environ. Chang.* **2019**, *54*, 64–77. [CrossRef]
150. Næss, L.O.; Bang, G.; Eriksen, S.; Vevatne, J. Institutional adaptation to climate change: Flood responses at the municipal level in Norway. *Glob. Environ. Chang.* **2005**, *15*, 125–138. [CrossRef]
151. Gillard, R.; Gouldson, A.; Paavola, J.; Van Alstine, J. Can national policy blockages accelerate the development of polycentric governance? Evidence from climate change policy in the United Kingdom. *Glob. Environ. Chang.* **2017**, *45*, 174–182. [CrossRef]
152. Azhoni, A.; Holman, I.; Jude, S. Adapting water management to climate change: Institutional involvement, inter–institutional networks and barriers in India. *Glob. Environ. Chang.* **2017**, *44*, 144–157. [CrossRef]
153. Wooldridge, J.M. *Econometric Analysis of Cross Section and Panel Data*; Massachusetts Institute of Technology (MIT): Cambridge, MA, USA, 2010.
154. Dawson, J.F. Moderation in Management Research: What, Why, When, and How. *J. Bus Psychol.* **2013**, *29*, 1–19. [CrossRef]
155. Garreaud, R.; Alvarez-Garreton, C.; Barichivich, J.; Boisier, J.P.; Christie, D.; Galleguillos, M.; LeQuesne, C.; McPhee, J.; Zambrano-Bigiarini, M. The 2010–2015 megadrought in central Chile: Impacts on regional hydroclimate and vegetation. *Hydrol. Earth Syst. Sci.* **2017**, *21*, 6307–6327. [CrossRef]

156. Carrasco, C.; Rosner, R. The Chilean electricity sector confronts climate change. *Bull. At. Sci.* **2017**, *73*, 395–403. [CrossRef]
157. Baselli, G.; Contreras, F.; Lillo, M.; Marín, M.; Carrasco, R. Optimal decisions for salvage logging after wildfires. *Omega* **2020**, *96*, 1–9. [CrossRef]
158. Mazzorana, B.; Picco, L.; Rainato, R.; Iroumé, A.; Ruiz-Villanueva, V.; Rojas, C.; Valdebenito, G.; Iribarren-Anacona, B.; Melnick, D. Cascading processes in a changing environment: Disturbances on fluvial ecosystems in Chile and implications for hazard and risk management. *Sci. Total Environ.* **2019**, *655*, 1089–1103. [CrossRef]
159. Barcaza, G.; Nussbaumer, S.; Tapia, G.; Valdés, J.; García, J.; Videla, Y.; Arias, V. Glacier inventory and recent glacier variations in the Andes of Chile, South America. *Ann. Glaciol.* **2017**, *58*, 166–180. [CrossRef]
160. Bronfman, N.C.; Cisternas, P.C.; López-Vázquez, E.; Cifuentes, L.A. Trust and risk perception of natural hazards: Implications for risk preparedness in Chile. *Nat. Hazards* **2016**, *81*, 307–327. [CrossRef]
161. Ruiz, S.; Madariaga, R. Historical and recent large megathrust earthquakes in Chile. *Tectonophysics* **2018**, *733*, 37–56. [CrossRef]
162. Iribarren, P.; Mackintosh, A.; Norton, K.P. Hazardous processes and events from glacier and permafrost areas: Lessons from the Chilean and Argentinean Andes. *Earth Surf. Process. Landforms.* **2014**, *40*, 2–21. [CrossRef]
163. Moernaut, J.; Van Daele, M.; Fontijn, K.; Heirman, K.; Kempf, P.; Pino, M.; Valdebenito, G.; Urrutia, R.; Strasser, M.; De Batist, M. Larger earthquakes recur more periodically. New insights in the megathrust earthquake cycle from lacustrine Turbidite Records in South Central Chile. *Earth Planet. Sci. Lett.* **2018**, *481*, 9–19. [CrossRef]
164. Úbeda, Z.; Sarricolea, P. Wildfires in Chile: A review. *Glob. Planet. Chang.* **2016**, *146*, 152–161. [CrossRef]
165. Rojas, O.; Mardones, M.; Rojas, C.; Martínez, C.; Flores, L. Urban Growth and Flood Disasters in the Coastal River Basin of South-Central Chile (1943–2011). *Sustainability* **2017**, *9*, 195. [CrossRef]
166. Wilson, R.; Glasser, N.; Reynolds, J.; Harrison, S.; Iribarren, P.; Schaefer, M.; Shannon, S. Glacial lakes of the central and Patagonian Andes. *Glob. Planet. Chang.* **2018**, *162*, 275–291. [CrossRef]
167. Google. Satelital Map. 2021. Available online: https://satellite--map.gosur.com/es/ (accessed on 22 September 2020).
168. National Agroclimatic Network. *Agromet. 2021*; Ministerio de Agricultura: Santiago, Chile, 2021. Available online: https://www.agromet.cl/ (accessed on 22 August 2020). (In Spanish)
169. National Office of Emergencies. *Digital Repository*; Oficina Nacional de Emergencia: Santiago, Chile, 2021. Available online: https://repositoriodigital.onemi.gov.cl/ (accessed on 12 August 2018). (In Spanish)
170. Gooogle Earth. Lawrence, Kansas, USA. 2021. Available online: https://earth.google.com/web/ (accessed on 20 August 2018).
171. General Water Office. *Decrees*; Ministry of Public Works: Santiago, Chile, 2021; Available online: https://dga.mop.gob.cl/administracionrecursoshidricos/decretosZonasEscasez/Paginas/default.aspx (accessed on 25 July 2018). (In Spanish)
172. Library of the Congress. Decrees Library of the Congress: Valparapíso, Chile. 2021. Available online: https://www.bcn.cl/ (accessed on 22 July 2020). (In Spanish).
173. National Geology and Mining Service. Main Disasters that Have Occurred Since 1980 in Chile; Servicio Nacional de Geología y Minería, Santiago, Chile. 2006. Available online: http://sitiohistorico.sernageomin.cl/pdf/presentaciones-geo/Primer-Catastro-Nacional-Desastres-Naturales.pdf (accessed on 7 June 2018). (In Spanish).
174. Ministry of Environment. *Digital Base of Clima*; Ministerio del Medioambiente: Santiago, Chile, 2021; Available online: http://basedigitaldelclima.mma.gob.cl/study/one (accessed on 10 June 2019). (In Spanish)
175. Meteorological Directorate. *Climate Services*; General Directorate of Civil Aviation: Santiago, Chile, 2021. Available online: http://www.meteochile.cl/PortalDMC--web/index.xhtml (accessed on 22 July 2019). (In Spanish)
176. United Nations Development Programme. *The Trajectories of Human Development in the Chilean Communities (1994–2003)*; United Nations Development Chile: Santiago, Chile, 2006. (In Spanish)
177. Electoral Service. *Statistics*; Servicio Electoral: Santiago, Chile, 2021. Available online: www.servel.cl (accessed on 22 December 2020). (In Spanish)
178. National Council for Transparency. *Open Data*; Consejo para la Transparencia: Santiago, Chile, 2018. Available online: https://www.consejotransparencia.cl/datos--abiertos/ (accessed on 15 July 2018). (In Spanish)
179. Ministry of Finances. *Register of Collaborators*; Ministerio de Hacienda: Santiago, Chile, 2021. Available online: https://www.registros19862.cl/reportes/transferencias/reporte/ingresadas (accessed on 15 November 2018). (In Spanish)
180. Directorate of Budgets, Ministry of Finances. *Instructions for Execution of the Budget Law in Public Sector*; Dirección de Presupuesto (DIPRES): Santiago, Chile, 2021. Available online: http://www.dipres.gob.cl/598/w3-propertyvalue-15954.html (accessed on 28 July 2018). (In Spanish)
181. Techo. *National Land Registry of Camps 2005, 2007, 2013, 2014, 2015, 2016*. Available online: http://datos.techo.org/tr/dataset/catastro-campamentos-2016 (accessed on 23 January 2021). (In Spanish).
182. World Bank. *Chile, Data*; World Bank: New York, NY, USA, 2021. Available online: https://data.worldbank.org/country/chile (accessed on 23 January 2021). (In Spanish)
183. Andersson, K.; Gordillo, G.; van Laerhoven, F. *Local Governments and Rural Development: Comparing Lessons from Brazil, Chile, Mexico, and Peru*; University of Arizona Press: Tucson, AZ, USA, 2009.
184. Valdivieso, P.; Bernas, J. Difficulties of the approximation of transparency as a command and control policy: Chilean experience with municipalities. *Rev. CLAD Reforma Democr.* **2014**, *58*, 201–234.
185. Comptroller General of the Republic. Audit Reports; Contraloría General de la República, Santiago, Chile, 2021. Available online: https://www.contraloria.cl/web/cgr/# (accessed on 22 July 2019). (In Spanish).

186. Directorate of Budgets, Ministry of Finances. *Final Report Neighborhood Improvement Program*; Ministry of Finance: Santiago, Chile, 2012. Available online: https://www.dipres.gob.cl/597/articles-163123_informe_final.pdf (accessed on 2 October 2019). (In Spanish)
187. Directorate of Budgets, Ministry of Finances. *Management Strengthening Program*; Ministry of Finance: Santiago, Chile, 2010. Available online: https://www.dipres.gob.cl/597/articles-141149_r_ejecutivo_institucional.pdf (accessed on 2 October 2019). (In Spanish)
188. Dilling, L.; Pizzi, E.; Berggren, J.; Ravikumar, A.; Andersson, K. Drivers of adaptation: Responses to weather- and climate-related hazards in 60 local governments in the Intermountain Western. U.S. *Environ. Plan. A* **2017**, *49*, 2628–2648. [CrossRef]
189. Cameron, A.C.; Trivedi, P.K. *Microeconometrics Using Stata*; Stata Press: College Station, TX, USA, 2010.
190. Wolter, K.M. *Taylor Series Methods. Introduction to Variance Estimation*; Springer: New York, NY, USA, 1985.
191. Agresti, A. *Categorical Data Analysis*; John Wiley and Sons: New York, NY, USA, 1990.
192. Lindstrom, D. Schaum's Easy Outline of Statistics. McGraw–Hill Education: New York, NY, USA, 2010.
193. Superintendency of Pensions. *Data on Pensions*; Superintendencia de Pensiones: Santiago, Chile, 2021. Available online: https://www.spensiones.cl (accessed on 25 December 2020). (In Spanish)
194. Municipality of Cauquenes. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties: 2009–2016*; Municipality of Cauquenes: Cauquenes, Chile, 2021. Available online: https://www.cauquenes.cl/ (accessed on 13 June 2018). (In Spanish)
195. Municipality of Concepción. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of Concepción: Concepción, Chile, 2021. Available online: https://concepcion.cl/ (accessed on 15 June 2018). (In Spanish)
196. Municipality of La Florida. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of La Florida: La Florida, Chile, 2021. Available online: https://www.laflorida.cl/sitio/ (accessed on 17 June 2018). (In Spanish)
197. Municipality of Lebu. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of Lebu: Lebu, Chile, 2021. Available online: https://www.lebu.cl/ (accessed on 19 June 2018). (In Spanish)
198. Municipality of Osorno Annual Public Accounts. *Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties 2009–2016*; Municipality of Osorno: Osorno, Chile, 2021; Available online: https://www.municipalidadosorno.cl/ (accessed on 21 June 2018). (In Spanish)
199. Municipality of Panguipulli. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of Panguipulli: Panguipulli, Chile, 2021; Available online: panguipulli.cl (accessed on 22 June 2018). (In Spanish)
200. Municipality of Puerto Montt. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of Puerto Montt: Puerto Montt, Chile, 2021. Available online: https://www.puertomontt.cl/servicios/municipio--en--linea/ (accessed on 24 June 2018). (In Spanish)
201. Municipality of Renca. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of Renca: Renca, Chile, 2021. Available online: https://www.renca.cl/permisos--de--circulacion/ (accessed on 26 June 2018). (In Spanish)
202. Municipality of Valparaíso. *Annual Public Accounts, Community Development Plans, Meeting Minutes of Municipal Councils, Municipal Budgets, Staff, Regulatory Framework, Resolutions with Effects on Third Parties. 2009–2016*; Municipality of Valparaíso: Valparaíso, Chile, 2021; Available online: https://www.municipalidaddevalparaiso.cl/ (accessed on 28 June 2018). (In Spanish)
203. ProCalidad. Índice Nacional de Satisfacción de Clientes. Procalidad: Santiago, Chile. Available online: http://www.procalidad.cl/indice-nacional-de-satisfaccion-de-clientes/ (accessed on 3 September 2020). (In Spanish).
204. Library of Congress. *Law No 18834 Administrative Statute*; Library of Congress: Valparaíso, Chile, 2021. Available online: https://www.bcn.cl/leychile/navegar?idNorma=30256 (accessed on 27 December 2020). (In Spanish)
205. Vallejos, A.; Valdivieso, P. Towards second–order public policies in Latin America. *Andamios* **2014**, *11*, 323–352.
206. Fábrega, J.; González, J.; Lindh, J. Polarization and Electoral Incentives: The End of the Chilean Consensus Democracy, 1990–2014. *Lat. Am. Politics Soc.* **2018**, *60*, 49–68. [CrossRef]
207. Pérez, A.; Luján, D. Cercanía, favor, lealtad. Clientelismo en dos municipalidades chilenas. *Sociológica* **2018**, *33*, 235–268.

sustainability

MDPI

Article

Sanitation Upgrading as Climate Action: Lessons for Local Government from a Community Informal Settlement Project in Cape Town

Alma Elisabeth Peirson [1,*] and Gina Ziervogel [1,2,*]

[1] Department of Environmental and Geographical Science, University of Cape Town, Cape Town 7700, South Africa
[2] African Climate & Development Initiative, University of Cape Town, Cape Town 7700, South Africa
* Correspondence: almaelisabeth@gmail.com (A.E.P.); gina@csag.uct.ac.za (G.Z.)

Abstract: In light of the increasing call for climate action, there is a growing body of literature studying the ways in which informal settlements in the Global South are adapting to the impacts of climate change. In these particularly vulnerable communities where the existing infrastructural vulnerabilities faced by residents are exacerbated by the hazards of climate change, multi-level approaches involving more inclusive forms of governance are needed for the implementation of climate action. Drawing from the case of a sanitation upgrading project in the informal settlement of Murray, located in Philippi, Cape Town, this paper adds to current understandings of multi-level rapid climate action in informal settlements by endeavouring to address two gaps in this body of literature. Firstly, this paper demonstrates a link between climate change and sanitation which has received little attention by showing that improving sanitation infrastructure makes communities more resilient to extreme weather events associated with climate change. Secondly, the paper addresses how and by whom rapid climate action can be implemented in complex socio-institutional contexts such as informal settlements where the impacts of climate change are felt particularly strongly. This paper identifies what enabled and constrained climate action in the Murray informal settlement in an attempt to provide lessons for local government from the case of the sanitation upgrading project. Bottom-up initiation of multi-level climate action is dependent on fragile partnerships which require the support and involvement of a skilled and dedicated local government. Nevertheless, co-operative and transparent engagements across levels hold the potential to contribute to transformative adaptation through the establishment of new partnerships and forms of governance which recognise community groups as legitimate stakeholders and acknowledge the importance of lived experiences and mentalities.

Keywords: multi-level governance; climate change; informal settlements; local government; sanitation services

Citation: Peirson, A.E.; Ziervogel, G. Sanitation Upgrading as Climate Action: Lessons for Local Government from a Community Informal Settlement Project in Cape Town. *Sustainability* **2021**, *13*, 8598. https://doi.org/10.3390/su13158598

Academic Editors: David Tyfield, Rebecca Willis and Andy Yuille

Received: 26 June 2021
Accepted: 26 July 2021
Published: 2 August 2021

1. Introduction

In recent decades, the world's population has become increasingly urban, with over half of the global population currently living in cities [1,2]. Associated with this rapid urbanisation is an increase in the number of citizens living in informal settlements, particularly in countries of the Global South such as Kenya [3], India [4], and South Africa [5,6]. In most informal settlements, the roll-out and maintenance of basic service infrastructure severely lags behind that of more affluent areas, and the way in which utilities and municipalities engage with the contested concept of 'informality' is complex [7–9]. In Cape Town, South Africa, the lag in basic service delivery is largely a result of the deeply historical process of racial segregation which goes back to colonialism and the Apartheid regime. Protests, often involving the disruption of public life and the destruction of public facilities,

are used by many informal settlement residents as a way to voice their frustrations and attempt to secure infrastructure and services [10].

Inadequate access to services such as sanitation contributes to unsustainable conditions increasingly seen particularly in cities of the Global South [11]. Traditionally, achieving sustainable development tries simultaneously to balance environmental, social, and economic dimensions [12]. This understanding, often referred to as the triple bottom line, has recently been added to with the acknowledgement that governance and assets/technical dimensions are also critical for sustainable development, and are focused on in this paper [13]. However, the potential for achieving sustainable development is hampered by the impacts of climate change, which affect everything from food provision, water supply, and also sanitation infrastructure [14].

Climate change, which is referred to as an interconnected 'wicked problem' [15], exacerbates the structural vulnerabilities faced by informal settlement residents [16,17]. In urban areas, climate change has increased the risks faced by all persons, assets, economies and ecosystems [1]. The urban poor are particularly vulnerable to the hazards of climate change as their access to infrastructure and services such as water supply and sanitation is often precarious [2]. In the context of the contemporary city, marginalised communities residing in informal settlements most commonly bear the brunt of climate change related impacts [18–21]. In line with the increasing call for both rapid climate action as well as longer-term, transformative climate change adaptation, which aims to alter broader societal aspects by confronting issues such as power and justice [22,23], it is imperative to seek out the lived experiences of informal settlement residents. These residents who face climate and service delivery challenges on a daily basis are well placed to engage in finding suitable solutions for climate action.

The available evidence on climate trends from South Africa as well as greater Africa shows "increasing variability in precipitation events" [20] (p. 408). Furthermore, the contribution of anthropogenic global warming to extreme weather events such as flooding or prolonged rainfall deficits has been clearly demonstrated [24]. In the case of Cape Town, the effects of global warming can be seen in the fact that the metropole recently endured the worst drought of the last century, known as the 'Day Zero' water crisis [25,26]. Increasing number of flooding events can be attributed to more intense albeit potentially fewer rainfall events, as well as the consequences of urbanisation and surface hardening [18,19,27]. While both the effects of these climate impacts on informal settlements as well as the actions taken in response to these impacts have been studied and reported on, the link between climate change impacts and sanitation is one which has received limited attention. Discussions around climate change impacts and climate action often broadly refer to 'water and sanitation' as one area of study [2,28]. This is evident from the fact that Goal 6 of the UN Sustainable Development Goals calls for clean water and sanitation for all [29]. Thus, even though well-functioning sanitation systems are vital for human health, sanitation in and of itself is rarely seen as being directly impacted upon by climate change and is often missed or excluded from assessments of, and strategizing around, climate change impacts and adaptation [30]. However, sanitation infrastructure, and more broadly, the governing of sanitation, is indeed impacted, both directly and indirectly, by climate change.

Two of the most common forms of extreme weather events associated with climate change are dry weather with prolonged rainfall deficits and wet weather with heavy rainfall for extended periods of time. Limited water availability due to dry weather can increase pollutant concentrations in wastewater and result in clogged pipes [30,31]. In informal settlements, where water is often already in short supply and sewerage infrastructures is often failing or overburdened, this can result in highly polluted sewage overflowing into the streets at manholes and broken pipes, polluting the surrounding areas. As with dry weather, wet weather can result in the damage and loss of sanitation infrastructure as flooding increases the pressure on the combined infrastructure systems for water and wastewater [28,32]. As is commonly associated with the floods experienced during Cape Town's winter rains, sewage containing elevated faecal bacterial loads often overflows into

informal settlements, contaminating the soil and water surrounding residents' homes [20]. What the sanitation impacts of both extreme dry and wet weather have in common are the environmental degradation resulting from soil and water pollution, as well as the consequent health-related impacts [33]. Poor sanitation infrastructure in informal settlements can result in the faecal contamination of water, which causes the spread of waterborne diseases and presents a serious health hazard for local residents [31,34]. Thus, this paper argues that improving sanitation infrastructure is a form of climate action as it makes communities more resilient to the impacts of climate change by improving their access to suitable and effective sanitation infrastructure.

Having demonstrated the link between climate change and sanitation, the second area of literature to which this paper contributes is how rapid climate action around sanitation can be implemented and what roles various actors can take. While there are no off-the-shelf solutions to the impacts of climate change, it has been shown that reducing the climate risks experienced in informal settlement requires a shift towards new forms of more inclusive governance [18,35,36]. The move away from traditionally perceived state-centric, top-down 'government' towards the more bottom-up 'governance' is one which has been studied in great depth [37–39]. However, it is the more recently applied concept of 'multi-level governance', proposing a synergy between bottom-up and top-down approaches, which is increasingly seen as having the greatest potential to address climate risks such as those faced in Cape Town's informal settlements [20,40].

Research shows that multi-level governance, with participation and inclusivity in decision making, empowers and capacitates local communities, thereby increasing the chances of legitimate, transformative, and sustainable development occurring [36,41–43]. Key in the implementation of an inclusive governance approach for the sustainable provision of water and sanitation in a poorly serviced area are transparency and capacity building [36]. With the inclusion of a wider range of actors in multi-level governance, the influence of non-traditional actors such as Non-Governmental Organisation (NGOs) is growing [37,44]. Apart from formally established NGOs, community-based social movements and intermediaries who are urban poor themselves are also driving governance around issues such as service delivery [19,45]. The inclusion of communities in decision-making can enable co-operative engagement between local government institutions, communities and intermediaries in a manner which enables "the voice of the marginalized to be better heard and trusted . . . [so as to] support climate justice goals that recognize everyday risk" [46] (p. 3). This is particularly important in the highly politicized context of informal settlements, which, as is further explored later in this paper, is characterised by the consequences of historically entrenched inequality [18,47].

Although significant transformation has been achieved through engagements which involve citizens, the state and various intermediaries [36], empirical evidence shows that there are also extensive constraints to multi-stakeholder projects, which have been attempted in Cape Town with varying degrees of success [6,48]. Whether it be due to a "funding bottleneck" [49] (p. 8), a lack of support from local authorities [2,20], or conflicting convictions, flawed stereotyping, and lack of trust amongst actors [50], projects that host engagement across levels often fail to succeed. Considering the importance of the successful governing of service provision, particularly in light of the increasing hazards of climate change, it is imperative to identify how multi-level climate action is both enabled and constrained. This paper shares lessons from a sanitation upgrading project undertaken in the Murray informal settlement in Cape Town on how and by whom climate action across governance levels might best be implemented.

Notably, while discussions around climate change action often revolve around technical solutions, this paper acknowledges the fact that traditional responses to climate change frequently do not aid the urban poor [51]. In fact, local government solutions which focus solely on technical aspects often serve to entrench existing inequalities due to a lack of consideration for the complex socio-institutional context within which climate action in informal settlements is embedded [8,51]. The successful implementation of a climate action

such as the provision of sanitation infrastructure requires an understanding of the internal power struggles, priorities, and needs in an informal settlement, as well as the emotional overtones attached, particularly to services such as sanitation [19,52,53]. The different mentalities and lived realities of groups such as community organisations and even local government departments need to be acknowledged, as well as how these mentalities come together to politicize sanitation provisioning [10]. Moreover, the attitudes of different actor groups towards participatory processes and the ways in which they perceive each other shape engagements around the governing of climate action [41].

Consequently, this paper's identification of what enables and constrains climate action includes a careful reading and heightened awareness of the complex institutional and socio-political factors at play in the context of informal settlements. As in the case of the Murray sanitation upgrading project involved not only a community-based organisation and the local government but also various intermediaries, this paper also asks the question of how engagements between actors and the perceived roles of these actors influenced the relationships formed and the resultant co-operation—or lack thereof—towards multi-level governance. Because improving sanitation makes informal settlement communities more resilient to climate change, it is imperative to understand the complex processes for implementing climate action in this context. Upon presenting the methodology and findings of the research undertaken on the Murray sanitation upgrading project in Cape Town, this paper provides lessons for local government through a discussion on what enables and constrains multi-level climate action.

2. Materials and Methods

This paper applies a case study approach, utilising document review, transect walks, and semi-structured interviews undertaken in 2019, to shed light on a particular project involving engagement across levels, from city to neighbourhood, around the upgrading of sanitation. The focus on a single network of actors and their involvement in the provision of sanitation in an informal settlement provides a nuanced and intricate understanding into not only the technical aspects of sanitation provisioning, but also the complex social aspects. This paper is informed by the case of an informal settlement named Murray, located in Philippi, Cape Town, in which a multi-level sanitation upgrading project was initiated in 2017 by a community-based organization (CBO), the Informal Settlement Network (ISN). On behalf of the residents of Murray, ISN engaged with the non-governmental organisation (NGO), the Community Organization Resource Centre (CORC). Capacitated by the technical, financial, and relational support provided by CORC, as well as other international funding, ISN engaged in a partnership with the City of Cape Town Municipality (hereinafter referred to as 'the City') in the quest for improved sanitation infrastructure provision. Although the initial phase of the project showed signs of successful engagement and co-operation between the different groups, progress stalled in 2018, where after increasing frustration and tension became evident. Consequently, this project provides a rich case for the interrogation of both what enables and constrains multi-actor climate action in the social context of an informal settlement in Cape Town.

The research carried out for this paper was qualitative in nature, focusing on the behaviours and attitudes of research participants and the engagements between them [54]. The primary method for data collection was in-depth, semi-structured interviews during which a total of twelve participants across the various levels were asked a list of open-ended questions. An initial group interview with the regional leaders of ISN assisted in the identification of key interviewees, particularly among City officials and the members of the community-based project steering committee (PSC). As it became clear upon completion of the first few interviews that ward councillors also play an important intermediary role in the engagement between local communities and the City, two ward councillors were also interviewed as part of this study. It thus follows that representatives of all of the main groups involved in the upgrading project were consulted, providing a comprehensive

snapshot of the multi-level governance of sanitation infrastructure in the Murray informal settlement.

All interviews, with the exception of one, were audio-recorded with prior permission from the interviewees as indicated on the signed English-IsiXhosa bilingual consent forms. Audio-recorded interviews were transcribed as soon as possible upon their completion so as to enable the researchers to make note of any non-audial clues and gain a deeper understanding of the emotions and perceptions surrounding sanitation [54]. A thematic data analysis method was employed to analyse the findings by searching across the data set for repeated patterns and meanings [55]. The themes that emerged the clearest from the analysis process, and which were mentioned most frequently by the interviewees, were identified as the various enablers and constraints to multi-level climate action which are presented in the findings this paper. However, the analysis process also revealed the importance of mentalities, relationships, and engagements in the governance of sanitation infrastructure. Thus, upon presenting the case study context and upgrading events in the Murray settlement, this paper first provides a discussion around mentalities and engagements prior to presenting the enablers and constraints to climate action from which local actors may gain valuable lessons.

3. Results

3.1. Case Study Context and Upgrading Events

The informal settlement of Murray is located in Ward 80 in the Philippi area of Cape Town [56]. Philippi is one of the largest townships in Cape Town with 191 025 residents (2011 census), only 77.4% of whom have access to full-flush toilets that connect to the sewerage system [57]. Thus, for many, the human right to basic sanitation services and the safe disposal of human waste, as provided for in national legislation by the 1997 Water Services Act, has not been realised [11,58]. Because of a lack of repair and maintenance, countless residents who, according to City reports have access to sanitation, in fact, do not [10]. Murray's residents are among those whose daily lives are hampered by a lack of service provision, as residents live in shacks with no toilets or taps, and rely on communal standpoints to access water. The residents in the settlement used to have access to communal full-flush toilets connected to the sewerage pipeline running along the settlement's northern perimeter (see red line in Figure 1). When the research for this paper was undertaken in 2019, this sewerage pipeline had been largely non-functional since 2017. Increasingly severe sewage leakages from this pipeline due to blockages, and the resultant worsening living conditions for those living alongside the pipeline, spurred the community-based organisation, ISN, into action.

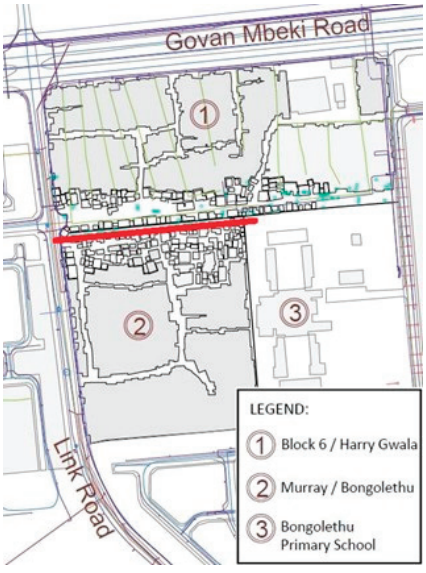


Figure 1. Map of the informal settlements of Murray and Block 6, as well as the Bongolethu Primary School. The sewerage line in question is indicated by the red line and connects from Link Road into the north-western perimeter of the school.

According to the local ward councillor, the informal settlement, known as 'Murray' to its residents and as 'Bongolethu' to City officials, was established in the late 1980s and has been fighting for access to water, sanitation, and electricity ever since. The provisioning of services to the settlement has, however, been hampered by the fact that the land on which Murray is situated is private property and does not belong to the City. Consequently, it has been challenging for the City to provide services inside the Murray settlement as this legally cannot be done without prior consent from the private landowner [5], and legislation hinders the budgeting or expenditure of municipal funds on land which does not belong to the government [20]. The fact that the Philippi area historically was not designed as a densely populated informal settlements further explains the struggle faced by City officials in providing services to its residents [57]. Several interviewees related the inadequacy of sewerage pipes in Philippi back to the structural segregation of Apartheid, suggesting that these pipelines were set up for a very basic level of service. As a result, the City officials whose job it is retrospectively to provide services in areas such as Murray are battling against an initial infrastructure outlay which is worse than that of the more affluent areas of the city.

Although Philippi has been poorly serviced in the past, the local government today has a responsibility to provide communities such as that of Murray with basic sanitation services [58]. The failure to provide services effectively is evident from the living conditions reported by interviewees across all levels, including City officials, noting that the settlement of Murray is characterised by extensive sewage overflow. This results in exposure of adults and children to the odours and bacteria of raw sewage, high rates of TB, and the flooding of homes by sewage-infused greywater, particularly in winter and during extreme weather events caused by climate change. It is in response to the increasingly unsanitary living conditions in the settlement that ISN, with the support of CORC as well as funding from international donors, initiated the upgrading project in partnership with the local authorities. A timeline of the major events forming part of the sewerage line upgrade in Murray is shown in Figure 2 [59].

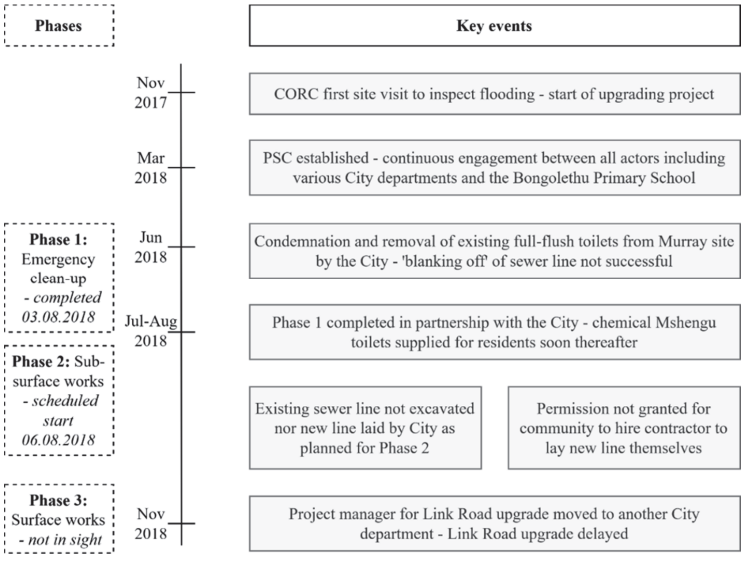


Figure 2. Timeline of major events forming part of the Murray and Link Road sanitation upgrading, highlighting the proposed phases of the project.

The overall aim of the ISN/CORC project in Murray was to upgrade the sewerage pipeline which runs along the settlement's northern perimeter and feeds into the larger Link Road sewerage infrastructure (see Figure 1). Prior to the upgrading project, the pipeline, which also services the adjacent Bongolethu Primary School, was functioning poorly, with sewage overflowing at manholes, pipe openings, and into the school. Consequently, the upgrading project consisted of three phases, namely (1) an emergency clean-up, (2) subsurface works to replace the old, fragile sewerage line, and (3) surface works including the installation of a series of wash stations and simple children's play structures (see Figure 2).

The project officially commenced in November 2017 when CORC conducted its first site visit, and by March 2018, plans had been developed and a project steering committee (PSC) had been established. The PSC, consisting of 12 residents from Murray and the adjacent Block 6 settlement, met weekly with ISN and CORC, with meetings open to representatives of the school and the various City departments. Although deemed by some as a contentious issue, it was decided, in conjunction with the City department responsible for informal settlements, that the full-flush toilets along the northern perimeter of Murray ought to be condemned and removed. The rationale behind this decision was that these toilets had been connected to a sewerage line intended solely for the discharge of sewage from the Bongolethu Primary School, as a result of which the capacity of the line had been exceeded, and extensive sewage overflow was occurring. In what was considered a significant contribution, the City condemned and removed these full-flush toilets in June 2018, providing the first necessary condition for the intended upgrading project. As a result of the available funding and the successful removal of the full-flush toilets by the City, Phase 1 of the project went ahead mostly as planned in July/August 2018. The northern bounds of Murray were cleaned by the community through a concerted effort of all of the involved parties. When the City further committed to delivering and maintaining chemical Mshengu toilets throughout the upgrading project, the residents, ISN, and CORC had a positive outlook and felt they "had the City on board" (Interview 6).

The Phase 2 sub-surface works were important as it was understood that excavating the existing sewerage line and laying a new one from Link Road to the school would solve Murray's problem of continued sewage overflow into the settlement itself. While the

City had committed to undertaking the necessary sub-surface works, this task was never carried out, and the team led by ISN felt that it had not been given a proper explanation as to why. The City's failure to undertake the promised sub-surface works marked a turning point in the multi-level engagements forming part of the upgrading project. It was noted by interviewees that what followed was a significant breakdown in co-operation and communication between the various groups involved.

Throughout the interview process, it became clear that the events of the upgrading project in Murray were inextricably linked to the sewerage infrastructure along Link Road (see Figure 1). Due to the historically poor roll-out of services in the Philippi area, the diameter of the Link Road sewerage pipeline was too small to accommodate the throughput it experienced. As a result, the pipeline was often blocked with sewage backing up into settlements such as Murray and overflowing at manholes and pipe openings. With plans in place to upgrade the Link Road sewerage pipeline, the City did not wish to put further pressure on the existing pipeline until the upgrade had been completed. Consequently, the promised Phase 2 sub-surface works were not undertaken as work on any lines feeding into the Link Road sewerage infrastructure had been put on pause until the completion of the Link Road upgrade. In light of this, ISN requested permission from the City to hire their own contractor using the funding available to them in order to lay a new sewerage line in Murray themselves. Although the City department responsible for informal networks offered to draw up a plan for this line, the department responsible for formal waste and water did not feel comfortable with an external contractor connecting onto public infrastructure, resolving instead to do internal investigations and installations themselves. This discord between local government departments resulted in no action taking place and no timeframes being offered to the community for the undertaking of the necessary internal City processes, leaving the community feeling frustrated and aggrieved as expressed in the following quote (Interview 1):

> *We're getting very angry now . . . [we] didn't need their money . . . [we] have our money . . . [we did] Phase 1, and . . . now, it looks like nothing had been done there because it's dirty . . . there are tyres . . . there were tyres before and now, there are tyres again . . .*

To make matters worse, the project manager in charge of the Link Road upgrade moved to another City department in November 2018. This caused the initiation of a new geotechnical investigation and a new community engagement process, as well as the postponement of the implementation timeline of the Link Road upgrade to the 2020/2021 financial year. Because of the complex interrelation between the sewerage infrastructure of Murray and Link Road, the residents of Murray were left in the lurch, with no functioning full-flush toilets, with continued sewage overflow, and without a clear understanding as to when the situation would improve. Notably, it was not only the lack of technical support from the City which caused frustration and anger, but also the apparent lack of responsiveness of the City. Furthermore, CORC, ISN, and the Murray residents felt that the City had, at times, dealt with them in a non-transparent manner, not allowing them to become involved in the governing of sanitation in their settlement. Thus, it became clear that complex socio-political factors and historically ingrained mentalities had affected the multi-level engagements which dictated the outcomes of this upgrading project.

3.2. Mentalities and Engagements among Actors and Levels

The successful implementation of climate action requires a level of relational capacity between the groups involved to be drawn on when necessary [46], which was not always evident in the case of the Murray upgrading project. The engagement between the community of Murray and the local government was frequently characterised by an 'us against them' mentality where the residents, whether involved in leadership or not, saw themselves as a homogenous 'community' unit standing against a similarly homogenous 'City' unit. Although some City officials and departments were highlighted by community members as having been either particularly helpful or unhelpful throughout the upgrading process, most mentions of 'the City' were in the form of predominantly negative blanket-referrals

thereto. Residents harboured significant frustration towards the City, accusing City officials of being the stumbling block for the project as they were "playing hide and seek" with the community (Interview 1). Furthermore, several members of the PSC and of ISN felt that, instead of involving residents in decision making, many City officials made decisions with little participation and input from the ground up. Requests for greater transparency were met with unexplained postponements of meetings and deadlines, as well as referrals to other City officials to handle the matter. As a result, the community displayed a lack of trust in the City, feeling as though they had done everything in their power, even contacting the Mayor for support, yet had little to show for their efforts. Their disappointment is clear from the following statement made by an ISN leader (Interview 5):

> *We have a relationship with the City . . . a partnership [between] ISN, CORC, and the City . . . but I don't think this partnership is working. Most of the time we get difficult things with the City officials . . . so, that's a problem. The City . . . must come to the [community] leadership. I think then we can work together. But if they do these things they are doing, we can't work together.*

Although seen as a largely homogenous group by the community of Murray, the various City officials involved in the upgrading project engaged with CORC, ISN, and the residents themselves in vastly different ways. One official, whose mandate is focused on informal settlements, takes a co-design approach to community participation, inviting community involvement in the development of plans. This official was vital in the drafting of the plans for the three-phase upgrading project in Murray and received praise from the community leaders and CORC alike for the way in which he engaged with the community regarding the project. On the whole, however, City officials seemed only narrowly to fulfil their mandate in terms of community participation by offering mostly one-way, informative communication from the top down rather than interactively engaging with the community. However, passive community consultation which does not go beyond token inclusiveness is not conducive to the multi-level governance of infrastructure implementation in response to climate change impacts.

The apparent gap between 'the community' and 'the City' is demonstrated in Figure 3, which visually represents the groups involved in the multi-level sanitation upgrading project. What is also demonstrated in the figure is the fact that the City makes a provision for a vertical structure which is meant to bridge the gap between the community and the City. This structure consists of ward councillors who are partially immersed into the community and who report to their respective sub-council, which in turn reports to and communicates with the area manager and line departments. The structure is also intended to work in reverse, with City officials mandated to inform the ward councillors who, in turn, liaise with the community. While City officials rely on this structure to fulfil their community engagement mandate, this structure does not seem to be working as it should, particularly in the context of informal settlements. From the interviews undertaken, direct contradictions were noted between the City officials who claimed to have provided timelines to the ward councillor, and the ward councillor himself who claimed not to have received such timelines. Although technology may have played a part in hindering communication, the breakdown in communication along the City's vertical network was also attributed to the political affiliation of the ward in which Murray is located, which differs from that of the City government. Poor communication and co-operation within the City's vertical structure had a negative impact on the technical implementation of sanitation infrastructure and the attitudes of the involved groups towards each other.

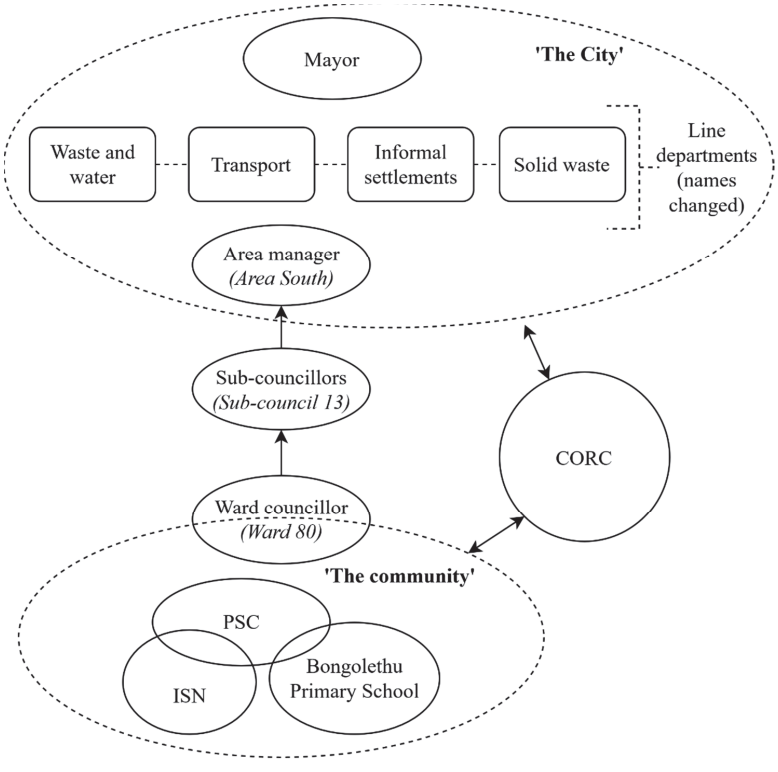


Figure 3. Visual representation of the groups involved in the multi-level upgrading project. It is not intended as an organogram of the City but rather represents the engagements observed between actors/levels.

3.3. Enablers and Constraints to Multi-level Climate Action for Improving Sanitation in Informal Settlements

From the interviews conducted, and the thematic analysis thereof, a set of factors emerged which both enabled and constrained the sanitation upgrading project in the Murray informal settlement. Summarised in Table 1 below, these enabling and constraining factors are explored in detail in the following sections, providing lessons for groups endeavouring to undertake similar projects.

Table 1. Summary of the enablers and constraints to multi-level climate action in the case of the Murray sanitation upgrading project.

No.	Enablers	Constraints
1	CORC in the role of the mediating intermediary	Lack of support and transparency from the city level
2	Strong community leadership enabling collective action	Complexities of informality hindering technical processes
3	City facilitating co-design activities	Mentalities arising from historical and political factors

3.3.1. Enabler No. 1: CORC in the Role of the Mediating Intermediary

The enabler of multi-level climate action which most clearly emerged from this study was the vital role of the intermediary, CORC, in bringing the community and the City

together. With no exception, all interviewees within 'the community' circle in Figure 3 expressed nothing but gratitude and praise towards CORC, thanking the NGO for assisting the people of Murray both technically and financially. Even among the City officials, the importance of an intermediary such as CORC was repeatedly recognised, with a specific emphasis placed on the role of CORC in helping to maintain the City's relationships with communities on the ground and keeping these communities up-to-date with the latest engagements. Beyond mediating engagements between the City and the community, CORC also pushed for progress by maintaining pressure on local government. The capacity of an intermediary to compel local authorities into action is particularly vital in the context of informal settlements where community leaders such as the members of ISN lack the voice and credibility to be heard and often do not have access to the technical assets, such as phones, airtime, or cars, which they need in order to engage effectively with City officials [17,46].

One main critique of CORC was offered by some City officials who stated that the NGO sometimes raises false hopes among community members, thereby negatively impacting on City–community relationships as promises made by CORC on behalf of the City may not be met. The challenge of maintaining the middle ground was addressed by the CORC representative in an interview as they admitted that it was sometimes difficult not to become too community-biased when faced with the deplorable conditions in which the residents live. At the same time, the CORC representative also recognized the difficult role which City officials play in navigating engagements with frustrated communities and delivering services in areas where no planned service layouts exist. It is this capacity to stand in the middle and recognize the challenges faced by both sides which makes strong intermediaries such as CORC imperative in enabling multi-level engagements to take action in response to the increasing need for improved sanitation infrastructure [37].

3.3.2. Enabler No. 2: Strong Community Leadership Enabling Collective Action

Strong social movements with committed leaders are vital for the achievement of multi-level governance [39,60]. It is specifically individual community leaders whose actions are central in intermediating between often equally frustrated residents, City departments, and NGOs [19]. The community of Murray showed robust and multi-faceted community leadership throughout the upgrading project with various community groups coming together, as demonstrated in Figure 3. The creation of the PSC held the ISN leaders accountable to their community and incorporated the voices of ordinary residents in the planning of the project. This created a sense of togetherness and community spirit among the various groups in the informal settlement. The multi-faceted community engagement would not have been possible without the ISN leaders functioning as "intermediaries of the urban poor" and coordinating the community's involvement [45] (p. 12). Furthermore, with local leaders taking the first step towards collective action, this enabled other actors, such as CORC, also to take part in the action for change [48]. Amidst the complexity of informal settlements, it takes community leaders working alongside more established and well-funded intermediaries such as CORC to enable effective engagement across levels and the establishment of communication channels with local authorities [4,61]. These communication channels are vital for the implementation of climate action on the ground.

3.3.3. Enabler No. 3: City Facilitating Co-design Activities

Although the City's engagement with the community of Murray is widely critiqued in this paper, it is important to recognize the largely unquantifiable yet significant time, effort, and resources which City officials contributed to the upgrading project. In interviews, the City officials recognized the unsanitary living conditions in Murray and empathized with residents' frustrations due to delays. While not all City officials acted upon their acknowledgement of the community's struggles, one official in particular invested significant amounts of time and energy into facilitating a co-design process with ISN and the PSC. This demonstrates the difference that an individual can make because of their specific skillset

and characteristics. It also demonstrates the fact that successful climate action requires the application of new forms of learning, particularly in the uncertain and politically charged context of informal settlements where it is vital for local communities to be recognised by the authorities as legitimate stakeholders [62,63].

In addition to their involvement in the Murray upgrading project, the City officials interviewed as part of this study also noted their contributions to projects aimed at tackling the broader social problems faced in informal settlements. These projects, which include, inter alia, the establishment of neighbourhood watches and the hosting of education programmes, are interconnected with the infrastructural sanitation challenges discussed in this paper. The more this broader work in informal settlements is connected to integrative co-design processes aimed at tackling particular climate change impacts, the greater the potential will be for City–community partnerships to have sustainable positive impacts. Furthermore, if both the community and the City come together, willing to communicate without cover-up strategies or flawed stereotyping [50], there is a greater chance for the transformative potential of multi-level climate action to be realised through co-designed solutions which build on the capacity and knowledge of bottom-up initiatives [52,64].

3.3.4. Constraint No. 1: Lack of Support and Transparency from the City Level

While the City's facilitation of a co-design process assisted in enabling the Murray upgrading project, the fact that the City did not undertake the required sub-surface works for Phase 2 was one of the main reasons as to why the project stalled. Although this could be explained in part by technical reasons, it was equally the lack of support and transparency from the City which hindered effective multi-level climate action in the case of Murray. As has been reported in other informal settlements in Cape Town [6], the breakdown in communication to and from the ward councillor earned the frustrations of those who rely on them to be their mouthpiece to the local municipality, and to report back to them any new developments. Furthermore, the lack of clarity regarding roles and responsibilities within the City made it difficult for the members of ISN and CORC to know where in the City to turn for assistance. The importance of clearly communicated mandates is evident in literature [45,49] and was demonstrated in the case of Murray by the fact that requests from the community were referred from one City official to another. The ISN leaders thus felt that they had not been granted the spot at 'the decision-making table' necessary to effect change [17], and lacked the voice and technical equipment necessary to be formally recognised in the historically unequal and exclusive context in which they were engaging with the City.

Notably, the City's lack of transparency not only resulted in the community feeling frustrated with the City but also negatively impacted the credibility of the ISN leaders among the residents of Murray. As the residents collectively completed the clean-up in Phase 1 based on the promise that the City would thereafter undertake sub-surface works, they were angry when the Phase 2 did not commence, and the ISN leaders could not provide an explanation as to why. This study suggests that a lack of support and transparency from the local authority both directly and indirectly hinders the undertaking of a multi-level project initiated by a local informal settlement community, confirming that the effectiveness of bottom-up community-initiated climate action is limited without the state's support and involvement [19,20]. The successful engagement in a multi-level partnership such as that in Murray requires the local authority to be open to continuous change and improvement which involves participation from the ground up [36].

3.3.5. Constraint No. 2: Complexities of Informality Hindering Technical Processes

Informal settlements are unique and challenging spaces for the implementation of sanitation infrastructure [8,10]. In many informal settlements, communities have settled on non-city land, which complicates the roll-out of services in those areas. Furthermore, for settlements such as Murray, there is no proper planned service layout and the established best practice methods intended to guide service provision are difficult to apply. This

hampers the ability of City officials to effectively govern these areas. Moreover, high levels of crime in informal areas discourage City officials from entering informal settlement communities as they fear being robbed. However, as much as the nature of informal settlements itself hinders the implementation of multi-level climate action, it is also the City's approach to informal areas which undermines effective partnerships between the city and neighbourhood levels. For example, in response to high crime rates, the interviewed community leaders urged officials to inform them of impending site visits so the leaders could be present in order to protect the City representatives. However, instead of adapting their methods to these opportunities for co-operation with informal settlements, many City officials reported sticking to traditional approaches and forms of communication, such as emailing ward councillors, which are not always easily accessible to the informal communities. Thus, the hindrances which are already present due to informality are compounded by a lack of adaptation to these hinderances by City officials and a lack of willingness to adopt the "new forms of learning" previously mentioned [46] (p. 3). It has been shown in literature that the solutions proposed by local governments are often technical in nature, ignoring, or even exacerbating the complex socio-political problems faced specifically in informal settlements [52,60]. This is evident in the case of the Murray upgrading project, in which a lack of understanding for—and adaptation to—the social complexities of informal settlements hindered the implementation of technical solutions and the multi-level governance of local climate action.

3.3.6. Constraint No. 3: Mentalities Arising from Historical and Political Factors

Although it is evident that historical and political factors play an important role in shaping the governance of sanitation in informal settlements [20], these aspects are difficult to assess due to their subjective nature which depends on differing mentalities [10]. Historical injustices tracing back to the Apartheid regime have left residents and ISN leaders alike with a sense of despondency, frustration, and mistrust in the formal City system due to, in part, a lack of inclusion in decision making [19,20]. This threatens efforts for collaboration between the City and informal settlement communities, and it has been shown that poor City–community relationships significantly constrain the multi-level governance of the provision of services in informal settlements [6].

As multi-level climate action interferes with conventional processes and methods, partnerships such as that attempted in the case of Murray can feel threatening to those in local government positions [65]. Thus, City officials fear making promises they cannot keep due to the historically tense relationship with informal settlement communities, making them enter a defence mode in which they shy away from transparency. The City's use of 'cover-up strategies' is also built on mistrust as it stems from an unwillingness to show doubts and internal struggles in order to avoid facing disappointments [50]. This speaks to the fact that City officials would like to work more closely with informal settlement residents to improve their living standards, yet instead of involving residents in decision making, many take on a "decide-announce-and-defend" method [66] (pp. 9–10).

The mentalities of both the community and the City generally serve to enlarge the divide between them, constraining multi-level climate action for improving sanitation infrastructure. Overcoming this constraint to enable more inclusive governance requires engagement with these mentalities and with the general political context of informal settlements in which power is highly contested [67].

4. Discussion and Conclusions

Drawing on literature around sanitation infrastructure in informal settlements and the need for multi-level climate action in the Global South, this paper contributes to current understandings around climate action by providing lessons for local government from a sanitation upgrading project in Cape Town. In theory, upgrading sanitation makes communities more resilient to climate change by improving their access to suitable and effective sanitation infrastructure. In Murray, the upgrading project was mostly unsuc-

cessful in bringing about this anticipated result, largely due to the three context-specific constraints outlined in this paper. Thus, it is imperative to understand how and by whom climate action can be implemented in the complex socio-institutional context of informal settlements.

The collective action and site-specific local knowledge of the residents and ISN leaders in Murray were fundamental in bringing about the successful completion of Phase 1 of the sanitation upgrading project. In their efforts to alter positively the service provisioning in their settlement, the residents, led by ISN and with the support of CORC, demonstrated a significant amount of agency and social capacity, which is fundamental in driving local climate actors [39,68]. While this considerably enabled the multi-level governance initiative, the success of the project was hindered by technical/infrastructural challenges as well as a lack of transparency and co-operation on the part of the City of Cape Town. This demonstrates that as much as the social capacity of non-state actors is vital, the chances of achieving the desired outcomes are limited without the support and involvement of a skilled and dedicated local government with high institutional capacity [19,20,38,39]. Local authorities play a central role in the implementation of policies and interventions which provide the infrastructure and services necessary in order for residents to be resilient in the face of increasing climate change impacts [1,2,69]. Thus, without reciprocated efforts from the local government, informal settlement residents often do not have the necessary capacity or resources to govern events and improve sanitation infrastructure, despite significantly contributing their own agency and even external funding [42].

Although challenging, inclusive multi-level climate action is needed to implement projects which bolster the resilience of informal settlements such as Murray in the face of climate change [2,9]. However, this cannot be undertaken independently at either the City or the community level. Instead, it requires co-operative and transparent engagement across levels in order for the full transformative potential of multi-level governance to be reached in the upgrading of informal settlement infrastructure [36,64]. Undoubtedly, the infrastructural challenges associated with informal settlements, such as the poor quality and insufficient capacity of existing pipelines along Link Road, hindered the success of the Murray upgrading project. Nevertheless, this case study supports the finding that one of the key barriers to the multi-level governance of infrastructure, particularly in informal settlements, is the socio-economic and political contexts in which the technical aspects of sanitation infrastructure are embedded [20,60]. This is evident from the fact that the three constraints outlined in this paper all relate to the historical and current socio-economic circumstances of the residents of Murray.

The communication methods employed by some City officials, such as emails to the local ward councillor, often failed to take into consideration the context on the ground and the fact that many community members would not have access to the technology necessary for information to be disseminated in this manner. Furthermore, even with the vital financial and technological support from CORC, the ISN leaders felt that they had not been recognised as legitimate stakeholders by the City [40] and that the implementation of the technical solution which they were proposing was dependent on a socio-institutional domain in which their voices went largely unheard due to, in part, the mentalities of City officials [10,41]. This implies that it is necessary for the groups involved in multi-level climate action to confront the socio-political context within which they find themselves by acknowledging each other's lived experiences and being aware of each other's mentalities, vulnerabilities, and histories [35,63]. By bringing together various groups with different lived realities and different forms of knowledge, multi-level governance can provide a space in which the complex socio-political dynamics currently hindering technical processes can be unpacked and addressed [49]. However, this contradicts the technocentric approach currently employed by many City officials which hampers the ability to recognise and engage with social and political dynamics such as power relations [70]. Future research into multi-level climate action is thus encouraged to shed further light on the ways in which

projects such as that in Murray can be enabled within their specific socio-institutional contexts.

Particularly in the context of informal settlements such as Murray, where poor communication and engagement in the past has resulted in despondency and mistrust, inclusive multi-level engagement has the potential to improve significantly not only infrastructure provisioning, but also City-community relationships as a whole. However, as noted by Adegun [20] (p. 417), "community-initiated bottom-up thrusts should . . . be seen in their true form—as potential", the realisation of which depend on a CBO's successful establishment of partnerships with NGOs and, importantly, with local government. Even if successfully established, these partnerships across levels are often fragile [71], and expectations of their effectiveness should be realistic, considering the contested context of informal settlements and the coming together of groups with vastly different mentalities and resources available to them [40]. Yet, it is in this complex socio-institutional context of informal settlements that the implementation of multi-level climate action is particularly important as it assists with more than only the implementation of rapid, short-term climate action such as the upgrading of a sewerage pipeline. Multi-level governance approaches hold the potential to contribute to transformative adaptation by addressing underlying social development challenges through the establishment of new partnerships and lines of communication which recognise community groups as legitimate stakeholders [23,71].

The three enablers outlined in this paper are good practice recommendations. These recommendations from the case of the Murray upgrading project should be tested in other socio-economic contexts to work towards building stronger multi-scalar partnerships. If these lessons are successfully put into practice in similar projects, this may lead to a broader transformation of the contested power relations and politics in informal settlements which currently stand in the way of their longer-term resilience to the impacts of climate change.

Author Contributions: G.Z. conceived of/conceptualised the presented ideas, acquired funding, and supervised the research project. A.E.P. and G.Z. together developed the methodology, sourced necessary resources, and undertook project administration duties. A.E.P. took the lead in carrying out investigations/interviews, analysing and visualising the data, and writing the original manuscript with support from G.Z., who reviewed and edited the manuscript and validated the results. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the AXA Research Fund, no grant number is available.

Institutional Review Board Statement: The study was approved by the Faculty of Science Research Ethics Committee of the University of Cape Town (approval number: FSREC 38-2019; date of approval: 7 May 2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data are not publicly available as consent was not requested for this purpose.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Pachauri, R.K.; Allen, M.R.; Barros, V.R.; Broome, J.; Cramer, W.; Christ, R.; Church, J.A.; Clarke, L.; Dahe, Q.; Dasgupta, P.; et al. *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; IPCC: Geneva, Switzerland, 2014; pp. 1–151.
2. Revi, A.; Satterthwaite, D.E.; Aragón-Durand, F.; Corfee-Morlot, J.; Kiunsi, R.; Pelling, M.; Roberts, D.C.; Solecki, W. Urban areas. In *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*; Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014; pp. 535–612.
3. Mulligan, J.; Bukachi, V.; Clause, J.C.; Jewell, R.; Kirimi, F.; Odbert, C. Hybrid infrastructures, hybrid governance: New evidence from Nairobi (Kenya) on green-blue-grey infrastructure in informal settlements. *Anthropocene* **2020**, *29*, 100227. [CrossRef]

4. Deshpande, T.; Michael, K.; Bhaskara, K. Barriers and enablers of local adaptive measures: A case study of Bengaluru's informal settlement dwellers. *Local Environ.* **2018**, *24*, 167–179. [CrossRef]
5. Mels, A.; Castellano, D.; Braadbaart, O.; Veenstra, S.; Dijkstra, I.; Meulman, B.; Singels, A.; Wilsenach, J. Sanitation services for the informal settlements of Cape Town, South Africa. *Desalination* **2009**, *248*, 330–337. [CrossRef]
6. Enqvist, J.; Ziervogel, G.; Metelerkamp, L.; van Breda, J.; Dondi, N.; Lusithi, T.; Mdunyelwa, A.; Mgwigwi, Z.; Mhlalisi, M.; Myeza, S.; et al. Informality and water justice: Community perspectives on water issues in Cape Town's low-income neighbourhoods. *Int. J. Water Resour. Dev.* **2020**, 1–22. [CrossRef]
7. Baptista, I. Electricity services always in the making: Informality and the work of infrastructure maintenance and repair in an African city. *Urban Stud.* **2019**, *56*, 510–525. [CrossRef]
8. Seeliger, L.; Turok, I. Averting a downward spiral: Building resilience in informal urban settlements through adaptive governance. *Environ. Urban.* **2014**, *26*, 184–199. [CrossRef]
9. Satterthwaite, D.; Archer, D.; Colenbrander, S.; Dodman, D.; Hardoy, J.; Mitlin, D.; Patel, S. Building Resilience to Climate Change in Informal Settlements. *One Earth* **2020**, *2*, 143–156. [CrossRef]
10. McFarlane, C.; Silver, J. The poolitical city: "Seeing sanitation" and making the urban political in Cape Town. *Antipode* **2017**, *49*, 125–148. [CrossRef]
11. Jackson, S.; Robins, S. Making sense of the politics of sanitation in Cape Town. *Soc. Dyn.* **2018**, *44*, 69–87. [CrossRef]
12. Weaver, A.; Pope, J.; Morrison-Saunders, A.; Lochner, P. Contributing to sustainability as an environmental impact assessment practitioner. *Impact Assess. Proj. Appraisal* **2008**, *26*, 91–98. [CrossRef]
13. Marques, R.C.; da Cruz, N.; Pires, J. Measuring the sustainability of urban water services. *Environ. Sci. Policy* **2015**, *54*, 142–151. [CrossRef]
14. Sathaye, J.; Shukla, P.R.; Ravindranath, N.H. Climate change, sustainable development and India: Global and national concerns. *Curr. Sci.* **2006**, *90*, 314–325.
15. Termeer, C.; Dewulf, A.; Breeman, G. Governance of Wicked Climate Adaptation Problems. In *Climate Change Management*; Knieling, J., Leal Filho, W., Eds.; Springer: Berlin, Heidelberg, 2013; pp. 27–39. [CrossRef]
16. Michael, K.; Deshpande, T.; Ziervogel, G. Examining vulnerability in a dynamic urban setting: The case of Bangalore's interstate migrant waste pickers. *Clim. Dev.* **2019**, *11*, 667–678. [CrossRef]
17. Henrique, K.P.; Tschakert, P. Pathways to urban transformation: From dispossession to climate justice. *Prog. Hum. Geogr.* **2020**, 0309132520962856. [CrossRef]
18. Desportes, I.; Waddell, J.; Hordijk, M. Improving flood risk governance through multi-stakeholder collaboration: A case study of Sweet Home informal settlement, Cape Town. *S. Afr. Geogr. J.* **2016**, *98*, 61–83. [CrossRef]
19. Drivdal, L. Flooding in Cape Town's informal settlements: Conditions for community leaders to work towards adaptation. *S. Afr. Geogr. J.* **2016**, *98*, 21–36. [CrossRef]
20. Adegun, O.B. State-led versus community-initiated: Stormwater drainage and informal settlement intervention in Johannesburg, South Africa. *Environ. Urban.* **2015**, *27*, 407–420. [CrossRef]
21. Pelling, M.; Garschagen, M. Put equity first in climate adaptation. *Nature* **2019**, *569*, 327–329. [CrossRef] [PubMed]
22. McNamara, K.E.; Buggy, L. Community-based climate change adaptation: A review of academic literature. *Local Environ.* **2017**, *22*, 443–460. [CrossRef]
23. Few, R.; Morchain, D.; Spear, D.; Mensah, A.; Bendapudi, R. Transformation, adaptation and development: Relating concepts to practice. *Palgrave Commun.* **2017**, *3*, 1–9. [CrossRef]
24. Pascale, S.; Kapnick, S.B.; Delworth, T.L.; Cooke, W.F. Increasing risk of another Cape Town "Day Zero" drought in the 21st century. *Proc. Natl. Acad. Sci. USA* **2020**, *117*, 29495–29503. [CrossRef]
25. Sousa, P.M.; Blamey, R.C.; Reason, C.J.; Ramos, A.M.; Trigo, R.M. The Day Zero Cape Town drought and the poleward migration of moisture corridors. *Environ. Re. Lett.* **2018**, *13*, 124025. [CrossRef]
26. Dosio, A.; Jones, R.G.; Jack, C.; Lennard, C.; Nikulin, G.; Hewitson, B. What can we know about future precipitation in Africa? Robustness, significance and added value of projections from a large ensemble of regional climate models. *Clim. Dyn.* **2019**, *53*, 5833–5858. [CrossRef]
27. Abiodun, B.J.; Mogebisa, T.O.; Petja, B.; Abatan, A.A.; Roland, T.R. Potential impacts of specific global warming levels on extreme rainfall events over southern Africa in CORDEX and NEX-GDDP ensembles. *Int. J. Climatol.* **2020**, *40*, 3118–3141. [CrossRef]
28. Howard, G.; Calow, R.; MacDonald, A.; Bartram, J. Climate Change and Water and Sanitation: Likely Impacts and Emerging Trends for Action. *Annu. Rev. Environ. Resour.* **2016**, *41*, 253–276. [CrossRef]
29. Herrera, V. Reconciling global aspirations and local realities: Challenges facing the Sustainable Development Goals for water and sanitation. *World Dev.* **2019**, *118*, 106–117. [CrossRef]
30. Dickin, S.; Bayoumi, M.; Giné, R.; Andersson, K.; Jiménez, A. Sustainable sanitation and gaps in global climate policy and financing. *NPJ Clean Water* **2020**, *3*, 1–7. [CrossRef]
31. Sherpa, A.M.; Koottatep, T.; Zurbrügg, C.; Cissé, G. Vulnerability and adaptability of sanitation systems to climate change. *J. Water Clim. Chang.* **2014**, *5*, 487–495. [CrossRef]

32. Jiménez, B.E.; Oki, T.; Arnell, N.W.; Benito, G.; Cogley, J.G.; Döll, P.; Jiang, T.; Mwakalila, S.S. Freshwater resources. In *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*; Field, C.B., Barros, V.R., Dokken, D.J., Mach, K.J., Mastrandrea, M.D., Bilir, T.E., Chatterjee, M., Ebi, K.L., Estrada, Y.O., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014; pp. 229–269.
33. Okonkwo, J.O. Sanitation, Potable Water Supply and Environmental Protection. Benefits, Progress and Issues for Sustainability in Developing Countries. Available online: https://www.africaportal.org/publications/sanitation-potable-water-supply-and-environmental-protection-benefits-progress-and-issues-for-sustainability-in-developing-countries/ (accessed on 1 June 2021).
34. Levy, K.; Smith, S.M.; Carlton, E. Climate Change Impacts on Waterborne Diseases: Moving Toward Designing Interventions. *Curr. Environ. Heal. Rep.* **2018**, *5*, 272–282. [CrossRef]
35. Shi, L.; Chu, E.; Anguelovski, I.; Aylett, A.; Debats, J.; Goh, K.; Schenk, T.; Seto, K.C.; Dodman, D.; Roberts, D.; et al. Roadmap towards justice in urban climate adaptation research. *Nat. Clim. Chang.* **2016**, *6*, 131–137. [CrossRef]
36. Guimarães, E.; Malheiros, T.; Marques, R. Inclusive governance: New concept of water supply and sanitation services in social vulnerability areas. *Util. Policy* **2016**, *43*, 124–129. [CrossRef]
37. Bridge, G.; Perreault, T. Chapter 28: Environmental Governance. In *A Companion to Environmental Geography*; Castree, N., Demeritt, D., Liverman, D., Rhoads, B., Eds.; Wiley-Blackwell: Oxford, UK, 2009; pp. 475–497.
38. Jordan, A. The Governance of Sustainable Development: Taking Stock and Looking Forwards. *Environ. Plan. C Gov. Policy* **2008**, *26*, 17–33. [CrossRef]
39. Evans, B.; Joas, M.; Sundback, S.; Theobald, K. Governing local sustainability. *J. Environ. Plan. Manag.* **2006**, *49*, 849–867. [CrossRef]
40. Enqvist, J.; Ziervogel, G. Multilevel Governance for Urban Water Resilience in Bengaluru and Cape Town. In *Water Resilience*; Springer: Cham, Switzerland, 2021; pp. 193–211.
41. Jiménez, A.; LeDeunff, H.; Giné, R.; Sjödin, J.; Cronk, R.; Murad, S.; Takane, M.; Bartram, J. The Enabling Environment for Participation in Water and Sanitation: A Conceptual Framework. *Water* **2019**, *11*, 308. [CrossRef]
42. Burris, S.; Drahos, P.; Shearing, C. Nodal Governance. *Australian Aust. J. Leg. Philos.* **2005**, *30*, 1–43.
43. Kim, S.; Lee, J. E-Participation, Transparency, and Trust in Local Government. *Public Adm. Rev.* **2012**, *72*, 819–828. [CrossRef]
44. Mills, G.; Hamukoma, N.; Doyle, N. *Cape Town: A Tale of Transitions. Future of African Cities Project*; The Brenthurst Foundation: Johannesburg, South Africa, 2019; Volume 2, pp. 1–23.
45. Ziervogel, G. Building transformative capacity for adaptation planning and implementation that works for the urban poor: Insights from South Africa. *Ambio* **2019**, *48*, 494–506. [CrossRef] [PubMed]
46. Ziervogel, G.; Enqvist, J.; Metelerkamp, L.; van Breda, J. Supporting transformative climate adaptation: Community-level capacity building and knowledge co-creation in South Africa. *Clim. Policy* **2021**, 1–16. [CrossRef]
47. Williams, D.S.; Costa, M.M.; Sutherland, C.; Celliers, L.; Scheffran, J. Vulnerability of informal settlements in the context of rapid urbanization and climate change. *Environ. Urban.* **2019**, *31*, 157–176. [CrossRef]
48. Eisenack, K.; Moser, S.C.; Hoffmann, E.; Klein, R.J.T.; Oberlack, C.; Pechan, A.; Rotter, M.; Termeer, C.J.A.M. Explaining and overcoming barriers to climate change adaptation. *Nat. Clim. Chang.* **2014**, *4*, 867–872. [CrossRef]
49. Borgström, S. Balancing diversity and connectivity in multi-level governance settings for urban transformative capacity. *Ambio* **2019**, *48*, 463–477. [CrossRef]
50. Termeer, C. Barriers to new modes of horizontal governance: A sense-making perspective. *Public Manag. Rev.* **2009**, *11*, 299–316. [CrossRef]
51. Anguelovski, I.; Shi, L.; Chu, E.; Gallagher, D.; Goh, K.; Lamb, Z.; Reeve, K.; Teicher, H. Equity impacts of urban land use planning for climate adaptation: Critical perspectives from the global north and south. *J. Plan. Educ. Res.* **2016**, *36*, 333–348. [CrossRef]
52. Eckerberg, K.; Bjärstig, T.; Miljand, M.; Mancheva, I. Devolving power from the state: Local initiatives for nature protection and recreation in Sweden. *Local Environ.* **2020**, *25*, 433–446. [CrossRef]
53. Taing, L. Implementing Sanitation for Informal Settlements: Conflicting Rationalities in South Africa. Ph.D. Thesis, University of Cape Town, Cape Town, South Africa, 2015.
54. Babbie, E.; Beiting-Lipps, E.; Kindstrom, K. *The Practice of Social Research*; CENGAGE Learning: Mason, OH, USA, 2015.
55. Braun, V.; Clarke, V. Using thematic analysis in psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [CrossRef]
56. Brown-Luthango, M. *State/Society Synergy in Philippi, Cape Town*; African Centre for Cities, University of Cape Town: Cape Town, South Africa, 2015.
57. Anderson, V.; Azari, S.; van Wyk, A. *Philippi Community Profile*; South African Education and Environment Project: Cape Town, South Africa, 2014.
58. Beck, T.; Rodina, L.; Luker, E.; Harris, L. Institutional and Policy Mapping of the Water Sector in South Africa. Available online: https://open.library.ubc.ca/soa/cIRcle/collections/facultyresearchandpublications/52383/items/1.0366056 (accessed on 1 June 2021).
59. Adato, M.; Lund, F.; Mhlongo, P. Methodological innovations in research on the dynamics of poverty: A longitudinal study in KwaZulu-Natal, South Africa. *World Dev.* **2007**, *35*, 247–263. [CrossRef]

60. Vedeld, T.; Kombe, W.; Msale, C.K.; Hellevik, S.B. Multilevel governance and coproduction in urban flood-risk management: The case of Dar es Salaam. In *Climate Change Adaptation and Development: Transforming Paradigms and Practices*; Inderberg, T.H., Eriksen, S., O'Brien, K., Sygna, L., Eds.; Routledge: Abingdon, UK, 2015; pp. 117–138.
61. Patel, S.; Baptist, C.; D'Cruz, C. Knowledge is power—Informal communities assert their right to the city through SDI and community-led enumerations. *Environ. Urban.* **2012**, *24*, 13–26. [CrossRef]
62. Collins, K.; Ison, R. Jumping off Arnstein's ladder: Social learning as a new policy paradigm for climate change adaptation. *Environ. Policy Gov.* **2009**, *19*, 358–373. [CrossRef]
63. Henrique, K.P.; Tschakert, P. Contested grounds: Adaptation to flooding and the politics of (in)visibility in São Paulo's eastern periphery. *Geoforum* **2019**, *104*, 181–192. [CrossRef]
64. Zhang, Y.; Liao, Y. Participatory Budgeting in Local Government: Evidence from New Jersey Municipalities. *Public Perform. Manag. Rev.* **2011**, *35*, 281–302. [CrossRef]
65. Lang, D.J.; Wiek, A.; Bergmann, M.; Stauffacher, M.; Martens, P.; Moll, P.; Swilling, M.; Thomas, C.J. Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustain. Sci.* **2012**, *7*, 25–43. [CrossRef]
66. Murombo, T. Beyond Public Participation: The Disjuncture between South Africa's Environmental Impact Assessment (EIA) Law and Sustainable Development. *Potchefstroom Electron. Law J.* **2008**, *11*, 1–20. [CrossRef]
67. Fox, A.; Ziervogel, G.; Scheba, S. Strengthening community-based adaptation for urban transformation: Managing flood risk in informal settlements in Cape Town. *Local Environ.* **2021**. [CrossRef]
68. Ziervogel, G.; Cowen, A.; Ziniades, J. Moving from Adaptive to Transformative Capacity: Building Foundations for Inclusive, Thriving, and Regenerative Urban Settlements. *Sustainability* **2016**, *8*, 955. [CrossRef]
69. Bulkeley, H. Reconfiguring environmental governance: Towards a politics of scales and networks. *Polit Geogr.* **2005**, *24*, 875–902. [CrossRef]
70. Lawhon, M.; Murphy, J.T. Socio-technical regimes and sustainability transitions: Insights from political ecology. *Prog. Hum. Geogr.* **2012**, *36*, 354–378. [CrossRef]
71. Ziervogel, G. Climate urbanism through the lens of informal settlements. *Urban. Geogr.* **2020**. [CrossRef]

sustainability

MDPI

Article

The Remaking of Institutions for Local Climate Governance? Towards Understanding Climate Governance in a Multi-Level UK Local Government Area: A Micro-Local Case Study

Erica Russell * and Ian Christie

Centre for Environment and Sustainability (CES), Arthur C Clarke Building, Stag Hill Campus, University of Surrey, Guildford GU2 7XH, UK; i.christie@surrey.ac.uk
* Correspondence: erica.russell@surrey.ac.uk

Abstract: The crisis of climate disruption and shortcomings in top-down approaches has focused attention on the effectiveness of governance to achieve climate goals. New sub-national governance models such as business alliances, city networks and NGO coalitions have emerged; such institutional 're-making' is often motivated by frustration at national inaction, and by a belief thatlocal actors offer an effective 'bottom-up' approach. Literature on the emergence of climate-led multi-level and polycentric governance focuses primarily on cities; the role of urban-rural counties and of the micro-level of local government, and the challenges and opportunities before them, is less well studied. This paper draws on work in progress in a study exploring progress, challenges and failings in UK climate governance across multiple levels of county-based government: Surrey, an area of towns, peri-urban districts and countryside, is offered as a case study, with a focus on micro-level action in small towns and parishes. We find that despite a lack of national government orchestration or sub-regional frameworks, climate action is occurring voluntarily at all levels of governance. However, the nature of action is variable and irregular and there is little evidence as yet to demonstrate effectiveness. A fragmented form of multi-level governance is observed, with limited upward flows of ideas and no indication of national interest in micro-local climate lessons and experience. We identify the importance of 'wilful actors' and the need for greater coordination, information- and knowledge-sharing networks to achieve effective institutional 'remaking' for climate action.

Keywords: climate change; multi-level governance; institutional remaking

Citation: Russell, E.; Christie, I. The Remaking of Institutions for Local Climate Governance? Towards Understanding Climate Governance in a Multi-Level UK Local Government Area: A Micro-Local Case Study. *Sustainability* **2021**, *13*, 13817. https://doi.org/10.3390/su132413817

Academic Editors: David Tyfield, Rebecca Willis and Andy Yuille

Received: 15 October 2021
Accepted: 8 December 2021
Published: 14 December 2021

1. Introduction

As the science of climate change has advanced, and concerns over climate disruption have mounted, in recent decades, interest has grown in the implications of climate crisis for governance, the complex interplay of governmental and non-governmental institutions, processes and cross-sectoral and multi-level relationships of policy actors in problem definition and problem solving, agenda setting, orchestration of strategies and policies, and the management of public goods (see, for example, [1–7]). The focus of research and policy development has been mainly at the global and national scales, with the evolution of trans-national institutions such as the UN Framework Convention on Climate Change, the International Panel on Climate Change, and policy making on climate within international networks such as the EU. There has been considerable attention in the academic and policy literatures on global and national governance of climate action in the context of ecological disruption, the negotiation of targets for greenhouse gas emissions reduction, and the failures of national governments to implement effective measures to achieve goals set in international agreements (see, for example, [4,5,8–14]).

There has also been significant work in academic research and policy development on the local governance of climate action—focusing predominantly on the role of urban municipalities and leading cities (see, for example, [15–23]). This reflects the political and

economic weight of major cities, and also the role taken by many of them in promoting more radical policies on the climate crisis than have been advanced by their national governments. We have seen the emergence of numerous city-led initiatives for climate action, such as the C40 Cities network at the global scale, and of initiatives led by urban mayors in the USA to accelerate climate action in the absence of leadership at the federal level following the Kyoto Protocol of 1997 [19,21,22].

The significance of local governance of climate policy as a source of exemplary and pioneering action across sectors [24] has been underlined by the well-documented and serious failure so far of national governments to implement international climate agreements, incentivise decarbonisation and set their economies on course for achieving net zero greenhouse gas emissions, consistent with the goals of the Paris Accord [5,25,26]. Together, the literatures on emergent climate governance approaches at global and city scales provide a significant body of knowledge and theory on the benefits and failings of top-down and bottom-up policy development, contributing to understanding of multi-level governance for climate action and more generally for sustainable development [2,4,6,7,15,27,28].

However, so far, the literature on governance and climate challenges has not focused to the same degree on local climate governance in non-metropolitan areas, where local administrations and their network relationships with other policy actors cover towns, peri-urban and suburban localities and rural districts, and include relationships with 'micro-local' institutions such as parish and small town councils. Such places generate a physical, political, social and economic 'mixed ecology' very different from that governed by major city authorities. Given the political and social significance of such territories, and the distinctive policy challenges they pose (for example, the greater degree of car dependence in affluent non-metropolitan areas than in cities and greater opportunities for re-forestation), it is important to explore the opportunities, problems and emerging patterns in governance of climate action at this scale.

We suggest that more work is needed on this level of governance to enhance our understanding of the development of institutions and processes for coping with climate change, and to enrich the well-established literatures on multi-level and polycentric forms of governance in general. More important, better understanding of local governance of climate crisis could help to improve its processes and outcomes, and thereby contribute to climate change mitigation and adaptation.

In this paper, we introduce some findings from an on-going research project in the UK, that aims to improve understanding of emergent climate governance institutions and processes at the sub-regional local scale in a non-metropolitan area, the county of Surrey in South-East England. We outline some initial results from a multi-level case study involving three layers of local government and related governance processes and networks.

While the research focus is specifically on this part of the UK, we hope that the approach taken and findings so far will resonate with researchers and policy makers in other contexts, given the wide range of states with similar challenges concerning the relationship between centralized national power and local/regional actors in the context of designing and implementing effective climate mitigation and adaptation strategies. The structure of this paper is as follows. We first set out the broad policy and research context for this study; then, in Section 2, we present our case study method at the micro-level of local governance in our selected area; in Section 3, we outline the results at the time of writing (early autumn 2021); finally, we discuss the findings to date.

1.1. The Policy Context

The policy context for this study is the existing framework of local government and governance in England, and the political debates about its future and the pressures on the system as it stands. The local government system has been subject to substantial reforms over the past half-century and a stable settlement remains elusive. There is a complex multi-level array of institutions in the formal local government system, complemented by a complex set of networks of cross-sectoral partnerships and other governance bodies.

There are unitary authorities, single-tier local government institutions overseeing services for an area: some are metropolitan areas, but some are rural-suburban territories. There are also multi-tier areas where a county council must work with borough (largely urban) and district (largely rural) smaller authorities, which in turn have below them parish and town councils, the smallest units of local government. Such an area is the county of Surrey, the focus of our project as explained below.

Alongside, and entangled with, these local government bodies are networks of local governance, in which public, private and voluntary sector bodies work in advisory, research, policy development, delivery and advocacy coalitions. Such bodies include the Local Economic Partnerships (LEPs) established by national government as forums and sub-regional agencies for local skills, infrastructure and investment; the new and rapidly evolving network of local Climate Commissions, established by local government bodies and partners independently of central government; and many long-standing multi-sector partnerships on aspects of policy such as nature conservation, waste, and local energy systems.

What these diverse local government and governance institutions have in common is the impact of the recent history of central government policy making in relation to local governance. The trend has been towards centralisation of power in English government, despite the numerous phases of local government reform over recent decades [29,30]; and local government has been subject to a major reduction in power and resources in the years since the global financial crash of 2008 [31]. The imposition of 'austerity', in particular since 2010 under the then Conservative–Liberal Democrat coalition government of the UK, has greatly constrained local government and governance bodies, reduced their funding and weakened their capacity [32]. The past decade has also seen the abolition of regional assemblies and development agencies in England, thus removing the regional tier of government and governance, and leaving regional and sub-regional coordination in the hands of complex overlapping networks of local councils, new combined authorities (run by elected mayors, mainly in major metropolitan areas), and partnership organisations such as the LEPs [33,34].

A major development at the local level has been the reduction in core grant financial settlement from central government and the subsequent loss of staff, skills and discretionary activities from local government services [31]. At the same time, the demands on the core statutory services provided by local councils—such as adult and social care—have grown, with the ageing of populations and the impact on physical and mental health of economic insecurities and, since 2020, of COVID-19 [35,36]. Additional finance for local government has typically been provided by central government via once-off targeted grants and via funds available on a time-limited competitive bidding process. Local government in England remains very restricted in its capacities to raise revenues locally and to engage in strategic planning and investment in major infrastructures [35,37].

These developments have greatly constrained the development of climate policy and its implementation at the local level: climate action has been pursued, but has been hampered by lack of political priority, funds, staff and skills [38]. However, in many local authorities and among their local governance partners, there have been numerous initiatives for climate action in spite of the unfavourable financial and operational context [24,37,38]. In 2019, the worldwide upsurge in climate campaigning (Extinction Rebellion, School Strikes for Climate, and Climate Emergency Declarations) sparked a wave of interest and activity in UK local government and among local governance actors. Climate Emergency declarations were made at a large scale [38].

The rise in salience and urgency of climate policy since 2018 has focused attention at the local level on the gap between aspirations and local potential for effective climate action on the one hand, and the institutional weakness of local government on the other. Calls for much greater attention to local potential and capabilities, for a clear framework for climate action, and for climate-focused institutional reform have come from local government representative bodies such as the County Councils Network [39] and UK100 [40]; from

national policy advisory bodies [41–44]; and from think-tanks (see, for example, [37,38,45]. These demands have in common a call for a coherent debate and framework concerning the role of local government and governance partners in the design and implementation of the UK Government's ambitious strategic goals for decarbonisation [46]; and a call for recognition of the essential role to be played by local actors in achieving net zero climate mitigation goals and implementing adequate adaptation measures in the face of climate disruption. This extract from the National Audit Office's [35] report on Local Government and net zero in England is representative of this body of critique, analysis and recommendations concerning policy gaps and lack of orchestration across levels of government in pursuit of effective climate governance and implementation:

> "*While the exact scale and nature of local authorities' roles and responsibilities in reaching the UK's national net zero target are to be decided, it is already clear that they have an important part to play, as a result of the sector's powers and responsibilities for waste, local transport and social housing, and through their influence in local communities. Government departments have supported local authority work related to net zero through targeted support and funding. However, there are serious weaknesses in central government's approach to working with local authorities on decarbonisation, stemming from a lack of clarity over local authorities' overall roles, piecemeal funding, and diffuse accountabilities. This hampers local authorities' ability to plan effectively for the long-term, build skills and capacity, and prioritise effort*." [35] (p. 12)

In recent years, in tandem with this wave of critical analysis of UK climate policy, we have seen the emergence and spread of a bottom-up movement for debate and institutional development concerning local governance of climate policy, in the absence of the called-for framework for national–local orchestration of net zero strategy and adaptation plans. The Place-Based Climate Action Network (PCAN, https://pcancities.org.uk, accessed 12 October 2021) has developed in recent years in the UK as a new force in climate governance, entirely initiated by local government and governance actors (notably universities) and based on the establishment of cross-sectoral local Climate Commissions as orchestrators and coordinators of climate strategies and projects at the local level [24,39]. The PCAN network began with a core of major cities (Leeds, Edinburgh, and Belfast) and has since expanded to include smaller metropolitan areas (Kirklees and Croydon); a major region (Yorkshire and Humberside in the north of England); and several counties spanning towns, suburbs and large rural areas (Surrey, Essex, and Cambridgeshire).

As we note below in Section 1.2, the emergence of the PCAN network and the widespread demands for a coherent framework to enable local climate action within a national strategy have highlighted a persistent theme in local climate governance over the past three decades: the way in which local actors have frequently developed policy in the absence of a clear framework from national government, or in the face of national leaders' opposition to climate action (as in the case of the USA under President Trump [47]). Where a framework for national–local shared planning, implementation and orchestration is missing, then piecemeal or coordinated bottom-up governance arrangements have emerged. Drawing on Patterson [48], we term this approach *'compensatory'* and *improvisational re-making* of institutions for climate action. The development of the still-patchy network of Climate Commissions at the local level in the UK is a case in point.

The changing policy context in the UK raises important questions about the design and implementation of effective institutions and processes for local climate governance. What should these be like? What seems to work well in new emergent systems for local governance of climate action? We suggest that the changes exemplified by the PCAN network and related initiatives [24] are signs that the UK is experiencing the beginning of what Patterson [48] terms institutional remaking for climate action:

> '*the activities by which agents intentionally develop political institutions in anticipation of, or in response to, institutional weaknesses and failures*' [48] (p. 25).

We reflect further on this point in Section 1.2 below, and then consider in detail emerging results from our current research into recent and prospective developments in local climate governance in the English county of Surrey, a local government area covering towns, extensive suburban zones, and rural districts. In particular, we describe work in progress in mapping and understanding such institutional remaking at the smallest scale of local government and governance in England, the town and parish level.

1.2. Understanding Local Climate Governance

As noted above, there is by now a large, rich and complex literature on climate governance from global to local scales. Valuable overviews of the field can be found in [2,5,6,9,13,21]. It is beyond our scope to reflect on more than a few elements of the literature that shed light on our research goal, that of exploring the emergence of micro-local institutions for climate action in a case study area in southern England. Below, we highlight briefly the following themes from the literature and use them to set the scene for our discussion of case study findings:

(A) The debate over multi-level and polycentric approaches and models for climate governance;
(B) The failings and challenges to effectiveness in climate governance, and the consequent need for remaking of institutions [48];
(C) The relative lack of attention paid to micro-level governance.

There is a substantial literature on the concepts and realisation in practice of multi-level governance (MLG) and polycentric governance (PG) in relation to climate action in particular and sustainability more generally (see, for example, [6,12,13,27]). Both concepts seek to represent the role and interaction of multiple levels and centres of policy making, implementation, coordination and agenda setting, recognising that systemic problems of the kind posed by climate change cannot be handled at one master level of government or via one mode of governance (i.e., the cooperation of governmental bodies with stakeholder organisations across sectors in problem definition, management and implementation of policies). They also have affinities with the ideal type concept of subsidiarity, in which functions are devolved to the most local level consistent with effective policy and decision making for the issue at stake. MLG and PG approaches recognise that climate change is a systemic challenge that has impacts at every scale from global to micro-local, and that must be governed accordingly in a flexible and multi-scalar way. They point to the need for new or adapted forms of 'orchestration' between institutions at the international, national and lower scales, to coordinate climate policy and achieve the goals established in global agreements on climate [1,49]. Research and policy questions then arise concerning what arrangements are being tried; what works and what does not; and what normative analysis can be made of what we ought to do for climate governance at multiple scales across sectors and levels of government.

Heinen et al. [6] offer a comprehensive review of the debates and distinctions offered concerning MLG and PG. We concur with their analysis, which suggests that the concepts have emerged from distinctive intellectual traditions (American and European approaches to governance) and that they have been used more or less interchangeably by many researchers: "As climate governance researchers draw on the intellectual foundations of both perspectives, it has been increasingly difficult to clearly distinguish between both concepts despite their different origins." [6] (p. 10). Heinen et al.'s [6] analysis of the literature generates a framework in which commonalities between MLG and PG become apparent and more significant than the distinctions offered by analysts. In effect, they propose a merger of MLG and PG perspectives. The common features in these perspectives are identified as follows by Heinen et al. [6] (p. 2 and p. 10):

- A recognition of climate change as an interdependent policy problem;
- The role of multiple decision makers, based on diverse relevant statutory responsibilities;
- The presence of multiple decision-making centres that must interact in diverse ways;

- The presence of 'rules in use' that shape and guide decision making—whether legally required rules or self-regulated processes; and
- The 'degree of dependencies'—the extent to which there is 'a formalized degree of dependency' among decision-making centres, 'which may be formally independent, formally interdependent, or choose to interrelate their decisions.'

Drawing on Heinen et al. [6], and given the entanglement of MLG and PG perspectives, we propose to use 'multi-level governance' as a term that spans both these concepts as they have developed in the literature. MLG refers not only to the formal statutory constitutional levels of government (central and local in the case of England, for example) but also to the 'horizontal' governance relations of collaboration with other bodies (such as multi-sector strategic partnerships) and to the 'vertical' relationships between tiers of government. Accordingly, we will present our case study of Surrey as one MLG in the face of climate challenges.

We turn now to the second major theme we wish to highlight from the literature: the constraints and problems affecting emergent institutions for climate governance. One important aspect of the debates over MLG, PG and climate governance is that, so far, climate policy in toto has been a failure, given the rise in global emissions despite multiple pledges and policy measures, and that the emergence of local governance innovations for climate action has been to a large degree based on frustration at the absence of effective policy and multi-level cooperation. Harris [5] identifies multiple sources of what he terms 'pathologies' in climate governance at the international and national scales. Stoddard et al. [26] review and attempt to explain the collective international and national failures to 'bend the curve' of greenhouse gas emissions and put the world on course for meeting the Paris Accord goals and keeping global average temperature rise to 1.5 degrees C. Parry et al. [25] analyse the extraordinary scale of subsidies from governments for fossil fuel interests worldwide. The power of established fossil fuel industries and their supporters and clients in governments and other bodies, and country-specific barriers to action rooted in national politics and economic path dependency, generate multiple interacting 'pathologies' [5] that have meant that, so far, international and national climate governance and political programmes for decarbonisation have been seriously compromised and have failed to stop the rise in emissions, let alone to reduce them at the global scale.

It is in this context that many high-profile local climate governance initiatives have emerged, whether at thr horizontal international level (as with for example the C40 network of cities, the R20 network of regional governments, and the ICLEI network of local authorities for sustainability) or at the local level within countries. The development of such collaborations and orchestrating institutions has taken place not only out of a positive impetus for making a contribution at the local and regional levels to climate action, but out of frustration at the failures of national governments and international actors to live up to their agreed goals for serious decarbonisation policies. See, for example, this statement from ICLEI [50] in the wake of the Rio + 20 conference on sustainable development in 2012:

> "*We now see that all the good will, energy, brain capacity and money that went into the Rio + 20 process have resulted in dozens of pages of paper, which contain hardly any commitment by governments. Instead, national governments reaffirm what they had already resolved long ago, list non-binding intentions, and acknowledge the activities by other actors such as local governments. It remains unclear who should be in charge and accountable for taking decisions on the transformative actions needed, and for rapid implementation. Do cities have to step in where governments are failing to take effective action? Cities are cooperating internationally without borders, without customs, without military forces. They can address the issues of the future without the global power play that we see going on at inter- governmental level. We have once more seen governments defending national interests rather than working together on a common global agenda. We suspect that the mechanisms, rules and routines of international diplomacy are outdated and incapable of designing and bringing about a sustainable future.*" [50].

Similar comments can be found from leading figures in the C40 Cities movement and other networks over the past decade, expressing dismay and frustration at inaction from national governments. Many leaders at this scale also present local governance bodies (above all, cities—see, for example, [51]) as the main agents of meaningful and responsible strategies and policy implementation for climate change mitigation and adaptation. However, despite the framing of local action as dynamic and innovative, as in the ICLEI statement above, it is clear that the development of many new local climate governance networks and institutions has been a unilateral response to MLG failures at 'higher' levels of policy making, and thus a *compensatory,* and far from optimal, partial governance innovation.

In this context, it is important to explore the emergent forms of local climate governance not only as potentially valuable innovations but also as developments that have been shaped faute de mieux by frustrated and determined local agents—not that local enthusiasm is any guarantee of coherent and capable follow-through in climate policy and effective governance innovations [38]. Patterson's [48] concept of institutional remaking is helpful in approaching the analysis of local emerging governance forms. This framework emphasises and offers a set of evaluative categories for description and assessment of local institutional forms that are evolving to cope with climate change and with the constraints and opportunities available in a given political and policy making context (see Table 1 below).

Table 1. Evaluation categories for institutional remaking [48].

Category	Description Indicators	Possible Empirical Measures	Indicator	Type
1. Comparative improvement	Substantive improvements within a given setting	i. Within-case problem solving ii. Between-cases problem solving	• missions reductions • Risk reduction • Social equity • Legitimacy • Institutional 'fit'	Comparative
2. Directionality of institutional change	Shaping the trajectory of institutional development	i. Immediate shifts ii. Shifts over time	• Radical institutional change • Shifts in power and authority • Cumulative and catalytic effects	Temporal
3. Capacity for social action	Ongoing capacity to remake institutions over time	i. Capability ii. Durability	• Agency • Opportunity structures • Persistent changes in rules, with meaningful consequences	Generative

Source: [48].

Patterson's definition of institutional remaking reflects the importance of considering the evolution of climate governance as a process of improvisation and (re)invention of institutions in the face of constraining or failing wider institutional frameworks:

> "*Institutional remaking is defined here as: the activities by which agents intentionally develop political institutions in anticipation of, or in response to, institutional weaknesses and failures . . . The term 'remaking' encompasses both the 'making' of new elements and the 'remaking' of existing elements, while emphasising that this (almost always) occurs within an existing (possibly already crowded) institutional setting [48] (p. 25), emphasis in original)*".

This approach seems to fit well with our and others' analysis of the conditions of UK local governance in the face of climate change and of the development of national climate policy without a clear account of how it relates to the rest of the multi-level government system in the UK and to stakeholders in local governance. We return to this point in our concluding discussion below.

The third theme we highlight from the literature is the lack of research to date on the micro-level of local climate governance. As noted above, the literature is dominated by studies of national, city and urban municipal governance, and there is much less attention to the smallest scales of local government and their partners in governance; a surprising situation considering the work of Ostrom [27,52,53] and the development of polycentric governance theory. In the multi-level system of the UK the parish and town council, and associated networks, constitute the lowest level of governance. We suggest that this is a potentially important level to investigate, as at the smallest scale of governance there is in principle a higher level of trust, contact and scope for civic engagement between citizens and representatives, and potentially a significant channel for transmission of information, practices and lessons learned between levels and actors in a multi-level governance system. We also suggest that in a multi-level or polycentric system, the kinds of problems affecting relations between national and sub-regional actors may be reproduced in new forms between the latter and the micro-level—as in the UK context, between county and district authorities on the one hand and their parish and town authorities on the other. We would expect to find evidence of Patterson's [48] institutional remaking in response, with new forms emerging at the micro-local level as well as among sub-regional levels (county and district/borough).

In light of this background analysis, this paper draws on an on-going research project that seeks to understand how sub-regional multi-level governance of urban and rural areas is adapting to climate change pressures and takes a case study approach to evaluate this within an English county (Surrey). The work maps the climate actions of Surrey's urban and rural councils following the UK's declaration of a national climate emergency in May 2019. Further, the analysis uses deductive coding, developed from the literature, to evaluate action by the various tiers of government and the change drivers underlying this activity. This allows us to consider the following questions: at the micro-local level is there evidence of collaboration and orchestration of governance; are we witnessing the remaking of institutions as suggested by Patterson [48]; and if micro-level climate governance is present does it conform to the features of MLG and PG outlined by Heinen et al. [6]. The implications of micro-level climate change governance are considered further in the discussion.

2. Materials and Methods

To address the questions raised in the introduction above, a case study research approach was considered appropriate due to the exploratory and explanatory nature of the work and as the knowledge base is still in development [54], with only limited research as yet into multi-level governance of climate crisis in the UK at the regional and local scales. The research aimed to map action by each tier of government within the selected area from May 2019 to the most recent point at which data were available. This would provide information that helped identify which governance bodies had declared climate emergencies, the type of action undertaken, and equally importantly highlight those who had taken little or no action.

This study has taken as its unit of analysis the climate action undertaken at different levels of sub-national government within one UK county, Surrey. The county provides a mixed peri-urban and rural area of some 1.2 million residents in the South-East of England, on the southern border of Greater London. Surrey is governed through multiple tiers of councils, a structure that is representative of many UK counties. The county council oversees the entire area, and within the county there are 11 borough or district councils and below this tier a range of town and parish councils. Surrey has no large cities but there are several significant towns, and a large part of the county is rural. Whilst mapping all Surrey Borough and District Council and sub-district government activity would provide an immensely rich and interconnected view of climate change action in Surrey, this was not feasible within the timeframe of the research. Instead it was decided to focus on one Borough, that of Waverley (see Appendix A for details of all councils within the study area).

Waverley was selected as an example of a mixed urban-rural area, with high emissions. The borough covers 345.2 km^2 and is, along with several other Surrey boroughs, highly prosperous overall, and ranked second in the UK in a recent think-tank ranking of affluence [55]. It has 121,572 residents [56]. Recent carbon footprint baseline work [57] by the University of Surrey for the independent Surrey Climate Commission identified Waverley emitting 522 ktCO2 in 2018, approximately 9% of the country's overall emissions. Emissions attributable to commuting and use of 'other' fuels are higher in this borough than any other, but its rural nature also supports one of the highest levels of carbon sequestration [58] The borough is divided into 21 civil parishes, of which three are town councils and the remainder are represented by parish councils (See Annex A for list). The three towns have a combined urban population of 78,118, with the smallest town having a population of 16,000. By contrast, the parish councils in Waverley represent much smaller numbers: the smallest has 185 residents, whereas there are over 11,000 people in the parish of Cranleigh [56]. Most parishes are rural. Waverley ranks highly on measures of social capital, both in terms of family and social networks as well as exhibiting trust in institutions and suggesting high levels of civic engagement [55].

Data for analysis were derived from council minutes, population statistics [59,60] and the nature of the council area in terms of its urban, urban/rural or rural nature. Council minutes were selected as suitable for this exploratory phase as they offered a standardized form of reporting on council activity, at all tiers. Indeed, all council types are required by UK law [61,62] to publish minutes of formal meetings not later than one month after the date of the meeting. Minutes and supporting documents are available for at least six years after publication [61], and whilst still available in paper format most are digitised. Such minutes offer detailed and factual notes which were easily accessible online. However, it should also be noted that the depth of information recorded can vary that such minutes are likely to exhibit a level of reporting bias and omissions [55]. Full council meetings and, where available, relevant sub-committees' minutes at each tier of government were utilised. All councils within this review had websites and provided online open access to all council minutes, with the exception of Peper Harow, the smallest parish in the sample. Due to the difficulties of accessing paper copies during the COVID period Peper Harow is not included in the analysis. Frequency of council meetings varies from monthly, often excluding August, to bi-monthly. More specific committees such as transport, health finance or planning were not reviewed, although these topics were frequently covered at sub-county council meetings. The mapping exercise defined the timescale over which the area is being studied. Whilst a national climate emergency had been declared in May 2019 the starting point for more detailed review was based on the slightly later climate emergency declaration by Surrey County Council in July 2019 [58]. The end date of the longitudinal study was April 2021, the last date for which minutes were available during our research period.

All minutes were read in full to ensure that all relevant text was identified, an important issue where climate change material is characterised by multiple key words, across many issues. Local parish websites and online news articles were additionally reviewed and where climate change was highlighted the text was also recorded. All text was logged, firstly in Microsoft Excel and then transposed into Nvivo (Version 12) for further textual analysis. During the mapping phase all text was categorised by nature of the activity, and these categories are presented in Table 2. The output from this work was a Microsoft Excel table (Table 2) providing a longitudinal analysis of the nature of climate action by county council, Waverley Borough and all town and parish councils within this borough. It should also be noted that to improve the presentation of the material rather than reference the minutes of each council within the text, the online source of the material is acknowledged in Appendix C.

To provide a richer understanding of the underlying drivers or nature of climate action, further textual analysis was undertaken using Nvivo 12 to support a deductive coding process. Deductive codes were drawn from the literature and a coding structure is

provided in Appendix B. All resulting material was then assessed by both researchers and the findings discussed and evaluated.

3. Results

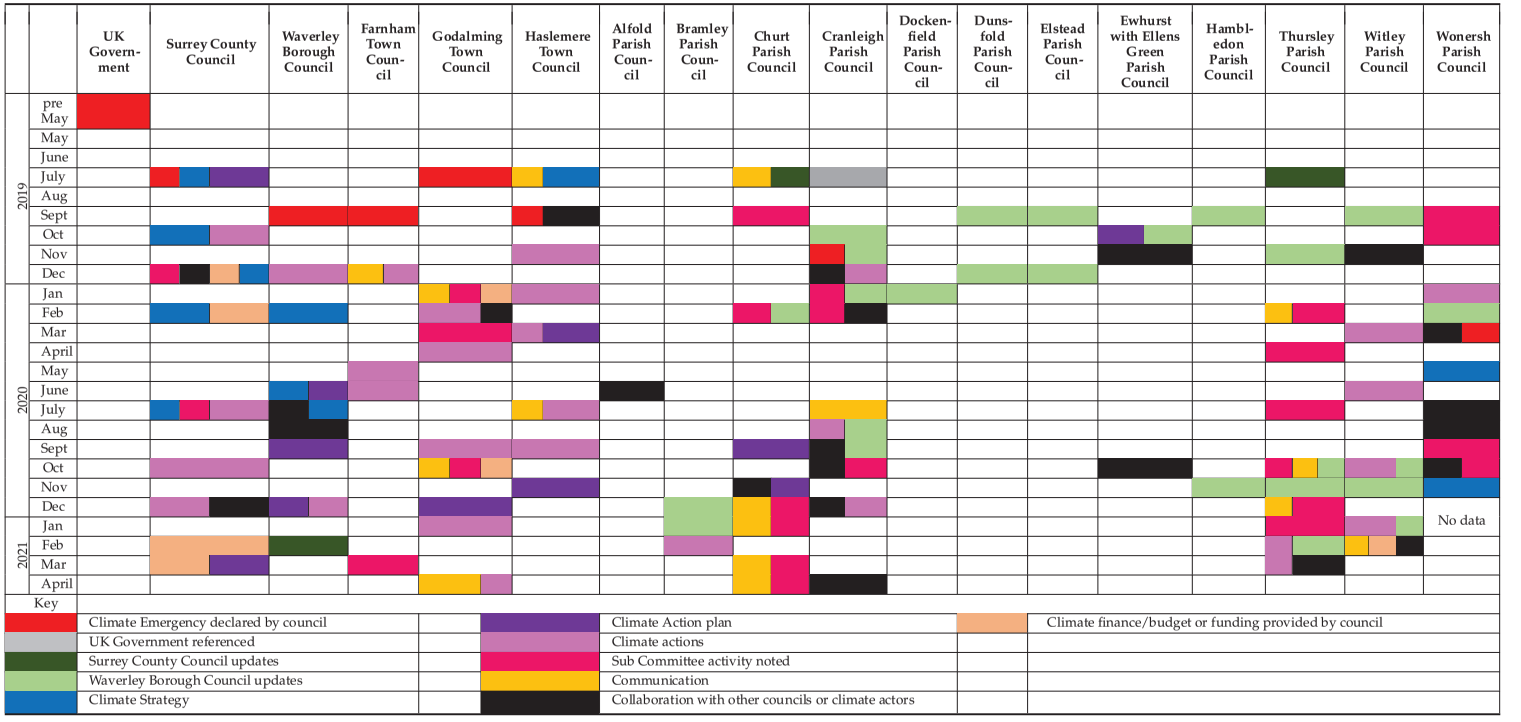
Council minutes were successfully accessed for all councils within the unit of analysis. Of the 23 councils comprising this case study, 73% of the councils included climate change issues within their meeting records, with five parish councils making no reference to climate change (see Table 2). Only 45% of councils are observed taking any climate action. Both the County Council and Borough Council record a wide range of activity, creating climate strategies, taking action, collaborating and developing action plans. Waverley also appear provide a key dissemination function in providing parishes with Borough Council climate action, with more than 60% of the parishes noting this in their minutes. It is clear that links to County Council work on climate are much more limited at this sub-borough level, with only three parishes detailing this in their notes. Only one, Cranleigh, mentions national government, and this shortly after the declaration of the national climate emergency. Similar to the Borough, the minutes of all three town councils suggest they are strongly engaged with the issue, although the records from Farnham suggest lower activity levels than their peers. We observe five parishes who have primarily incorporated climate into sub-committee work, are taking action, communicating climate change and collaborating with others. Two parishes have taken limited action, or worked more collaboratively with more climate active parish councils. Finally, five parishes have recorded a discussion of climate change in the context of updates from the Borough or County Council representative but appear to have taken no action. There is no indication in council minutes that the work being undertaken is attempting to achieve specific local goals, co-ordinated horizontally across peer groups or vertically at different governance levels. This includes direct contributions towards the achievement of the Waverley Boroughs Climate Action plan.

3.1. General Observations

The longitudinal nature of the data provides insight into the flow of information and timescale of engagement. The results of the analysis confirm that the county council, borough and town councils all declared climate emergencies within four months of the UK Government's national declaration, with only two parish councils since taking a similar stance (see Table 2). As highlighted in Section 1.1, such declarations are not mandated by government but represent a response to local stimuli, either internal or external to the council. Whilst it is clear in Table 2 that the first COVID lockdown forced a pause in activity, those councils most engaged with the subject have continued to embed climate activity, at a range of scales, within their policy processes.

For parish councils, Waverley Borough Council members appear to be a main source of climate governance information, with climate emergency declarations being included in their briefings to the local parish councils in the period September–December 2019. Updates were then undertaken in 2020 at the launch of their carbon neutrality action plan, even though recognising that 'targets are still thin and costs lacking' (Dunsfold PC). National climate action receives little mention, with only Cranleigh parish council highlighting the government climate emergency declaration in July 2019. Similarly, few councils mention the work of Surrey County Council in relation to climate policy. The three town councils have no direct climate change references to other governmental sources.

Table 2. An analysis of climate action by sub-national councils within borough of Waverley, July 2019–April 2021 (see Appendix C for links to source materials).



3.2. Size of Governance Unit

Much of the work on polycentric governance highlights the importance of ground-up, local initiatives generating collective action [63]; yet this exploratory study suggests that a small population may not generate public body-led action. Based on Table 2 councils were ranked as high, low, information-only or none in terms of the governance activity they have undertaken since the UK National climate emergency declaration. As is clear from the categorisation of activity these categories do not indicate effective climate outcomes. Due to the difference in population size and governance structure, town and parish councils were represented separately. The results, illustrated in Table 3, suggest there may be an alignment between population size and the level of climate governance activity (see Annex A for council by size ranking). Here, the divide appears to be less about urban and urban/rural council areas. We also see at least two councils with small populations ostensibly outperforming other larger population areas.

Table 3. Towns and councils by level of climate governance activity.

Level of Climate Governance Activity	Total Population	Average Pop./ Council Area	Council Size Ranking by Type
High (Town Council)	78,118	26,039	1,2,3
High (Parish Council)	24,636	4927	1,2,4,10,15
Low (Parish Council)	5950	2975	3,7
Info only (Parish Council)	6426	1285	6,9,11,12,16
None (Parish Council)	6719	1120	5,8,13,14,17,18

When level of climate governance activity is plotted across Waverley Borough parishes (see Figure 1), we see two geographical clusters emerging. Godalming, which declared a climate emergency in July 2019 and is highly active, forms an intersection between the two areas of high/low activity.

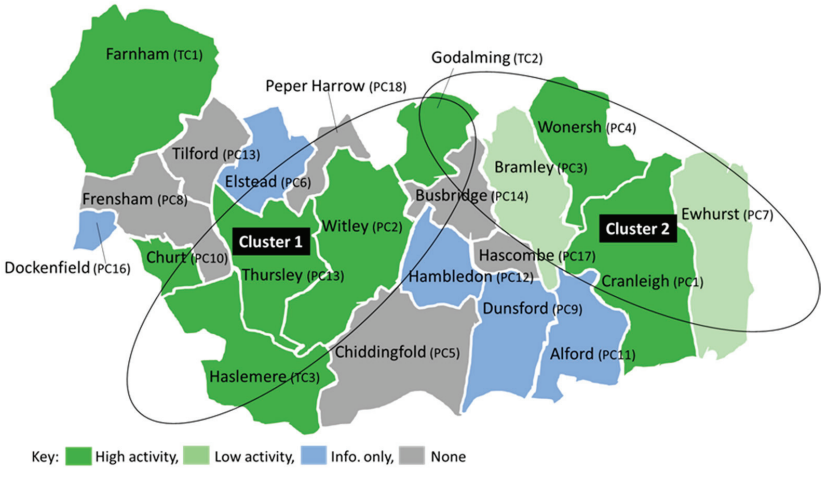


Figure 1. Levels of climate governance activity by parish.

This may suggest that smaller parishes such as Churt (PC10) and Thursley (PC15) in Cluster 1 may be influenced or supported by neighbouring parishes into greater activity than population size trends would indicate. Here, we may be witnessing an example of co-ordination or collaboration at a horizontal level. In contrast, in Cluster 2, Bramley (PC3) and Ewhurst and Ewell (PC7) are not performing as strongly as would be expected in

terms of their population size. Further assessment of the minutes was then undertaken to further draw out any indication of collaborative working. From this, a more nuanced picture emerges.

3.3. Knowledge Acquisition and Local Collaboration

Whilst minutes of council meetings are not sufficient to draw out complex interactions and relationships between individuals, this on-going research has been able to identify several routes by which inter-council collaboration and knowledge exchange have occurred.

Waverley Borough Council was seen by parish and town council members as a local leader, with their proposal of a 2030 net zero target (Haslemere TC) and their key role in dissemination of information. Leading councillors acknowledged a divide between small rural parish and town engagement and identified that 'it was important for the villages to be involved in the discussions rather than just the larger towns' (Waverley BC). Godalming and Cranleigh appear to be acting as local leaders at the sub-borough level. Godalming took an early lead in declaring a climate emergency, have set up working groups, and have taken action to offer financial support to local climate groups. Cranleigh has also been highly active in seeking external information and knowledge, looking to work with the University of Surrey, undertaking testing work on the University of Exeter carbon footprint tool, undertaking site visits and organising a Climate Change Event. Both of these councils have supported others in the borough, with Haslemere seeking guidance on criteria setting for environmental grants, a councillor providing information at a Churt PC meeting in February 2020 and Ewhurst linking to Cranleigh's repair café campaign (see Figure 2).

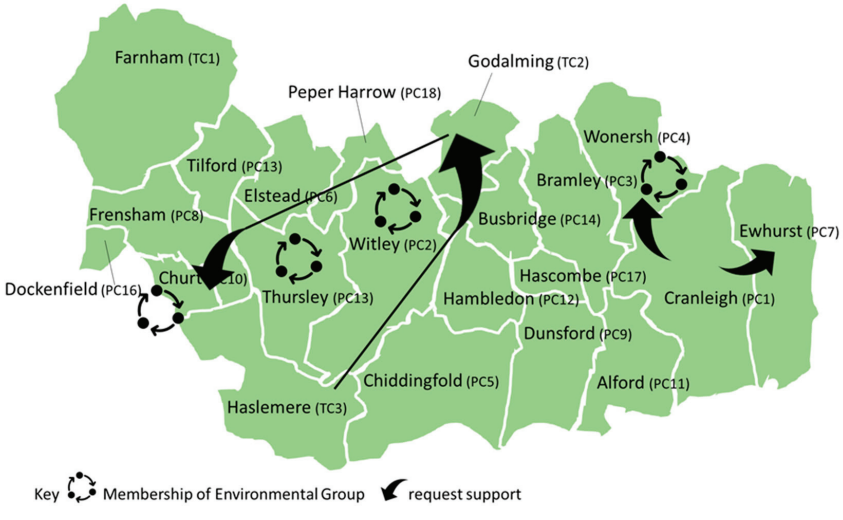


Figure 2. Collaborative engagement.

We also see the beginnings of engaged parishes beginning to develop collaborative working. As noted above, Cranleigh hosted an event delivered by the Centre for Sustainable Energy which involved local stakeholders from all tiers of Government. The discussion placed 'an emphasis upon the role of parish and town councils in enabling purchasing and behaviour change, drawing upon sustainable development goals' (Wonersh PC). The Churt PC representative noted a low attendance by neighbouring parishes but felt the event had led to 'a good dialogue with a councillor from Thursley PC who is actively engaging the public in Thursley' (Churt PC). More recently, a multi-parish environmental group has formed, something that was in discussion in March 2021, when minutes noted that councillors 'had spoken to Witley Parish Council who are in the early stages of their

discussions on the matter but that a multi-parish collaboration arrangement had been discussed.' (Thursley PC).

Whilst it is clear that many of the parishes primarily rely on Waverley Borough Council for governance updates, councils across the borough appear to draw on their councillor's knowledge of external organisations for climate guidance and information. Rural parish councils exhibit strong links with biodiversity and land-based organisations, such as Plantlife, Butterfly Conservation and the Surrey Hills Management plan. Town and borough councils appear to reflect a more urban focus, with recommendations to seek information from the Energy Saving Trust and the Carbon Savings Trust on electric vehicles. Three organisations—the Friends of the Earth [63], the Centre for Sustainable Energy (CSE) and the Local Government Association—offer specific climate change guidance for sub-regional councils, with CSE holding a conference for the borough councillors, and then for clerks, in 2020. This localised approach-although events seem to have been poorly attended-was felt to offer valuable learning and opportunities for collaboration (Thursley PC) and new initiatives (Haslemere TC). The research also reveals council interaction with business as a source of knowledge, with councillors attending a presentation on zero carbon homes and others visiting the site of a biodigester and community composting.

Understanding the measurement of carbon and learning how to set baselines are much less explored in debates and exchanges at the parish and town levels. With the exception of the county council, only two councils in the Waverley area, Godalming TC and Cranleigh PC, have considered or implemented carbon footprinting. Cranleigh seems to have been particularly proactive, working with the University of Exeter as one of 170 parishes testing a new community carbon footprint tool; IMPACT [64]. They have additionally looked to the local University of Surrey for student support in developing their strategy.

Such engagement with academic and research institutions appears unusual at a sub-regional level, although the county council does include University experts in advisory boards and commissions research projects. More generally, Surrey County Council officers are working through the Surrey Association of Local Councils (SALC) and the professional body for council clerks (SLCC) 'to establish best practices protocols for reporting environmental implications of recommendations and setting baselines. (Surrey CC). It should also be noted that there was no indication of any online platform for sharing learnings or experience across the borough or county.

3.4. 'Wilful' Actors

In trying to understand why parishes and boroughs have developed new forms of governance to support action on the climate emergency, our research, so far, suggests that 'wilful' actors have played a role. We define these as local policy actors who have initiated 'do-it-yourself' action in the absence of support, guidance or leadership from higher levels of governance: they can be seen as local agents in the institutional remaking process analysed by Patterson (2021) and noted above.

Three types of 'wilful' actors have been identified in the analysis to date:

- unaffiliated local resident(s);
- A resident member of an environmental group;
- A climate-engaged council member.

Such actors attending meetings and putting pressure on councils to act appear to be most dynamic at a town and borough level.

The most frequently recorded actors of this kind are those representing environmental groups, most of which are specific to the area or act as local elements of global organisations. At the most local level, a newly formed residents environmental working group in Churt to Plastic Free Farnham and Plastic Free Godalming. Haslemere residents appear to be particularly active with representation from the Sustainable Business Initiative, a residents' group; and from the Haslemere Climate Alliance, Transition Haslemere and a representative from the Eco-Church movement of the Diocese of Guildford, all in favour of a climate emergency declaration. Extinction Rebellion members are linked with three council climate

debates, including Surrey County Council, which experienced extensive group pressure. In Godalming, council members were challenged by a member of Friends of the Earth on deployment of solar panels.

Independent resident voices appear less frequently, but certainly at a parish level are important, raising practical changes such the introduction of electric vehicle charging points and street lighting switch-off policies (Bramley PC). Residents attending council meetings in Farnham, Godalming and Haslemere supported climate emergency declarations, and in Haslemere were backed by a 600-signature petition. Less visible through council minutes are individual councillors who are not just interested and support climate change, but who push for action and drive change. This is seen particularly strongly in Churt, with the Parish Clerk inviting the Centre for Sustainable Energy to present to the Surrey parish clerks and in the development of a Climate net zero website for the parish by the Environment Portfolio holder. At a county level, the councillor representing the Green Party offers both support and challenge to Surrey County Council.

3.5. Finance

The research identifies the importance placed by sub-regional councils on the role of the UK government in supporting climate change action; it is 'essential for central government to provide powers, funding and other resources' (Farnham TC). This is echoed at borough and county levels, aligned to concerns of local service trade-offs: 'to be able to secure funding from the government for this strategy rather than use funding that his currently supporting vulnerable Waverley residents' (Elstead PC). Our work, so far, on Surrey also indicates that, at the borough level, councils are lobbying local MPs to support 'the provision of necessary powers and resources to enable all UK local authorities to achieve carbon neutrality by 2030′ (Waverley BC). At the county level, 'the Council's credibility on addressing climate change was dependent on significant investment, strengthened dialogue with Local Enterprise Partnerships and the Government' (Surrey CC). Surrey County Council officers have identified, through work by the University of Leeds and the University of Surrey, a requirement of approximately £1 billion in investments to enable the net zero transition and related environmental policies in the county (Surrey CC).

Even though local parishes have very limited budgets, there was at least one example of grant funding being allocated to tree planting, and other two parishes collaborated to raise over £20,000 for fire damage to a local heath. Both Godalming and Haslemere TC's have set up small green grant schemes, supporting carbon reduction projects and basing value for money on the amount of carbon saved per pound awarded. One small Godalming grant of £3000 for a cycle way feasibility study resulted in £200,000 of Strategic Community Infrastructure Levy funding to undertake the work. Waverley BC have incorporated carbon reduction requirements into their procurement process. Funding is being allocated at a county council level, such as £49 million for Surrey Ultra-low and Zero Emissions schemes, £32 million to remove polluting buses and £6.3 million for community transport. Concerning the County Council's £100 m Community Investment Fund launch, councillor feedback noted that the fund was to be used to support 'meaningful projects in local communities—not solely restricted to climate change' (Surrey CC). There was no indication whether or how funding would be allocated at a more localised level for parishes and towns, or for local networks.

3.6. Orchestration and Subsidiarity

The research, so far, has found no examples that climate change governance was being orchestrated across the multiple tiers of councils reviewed. While Waverley Borough councillors did provide updates to parishes on the climate emergency, this did not appear to be linked to any management of response or action. Reference to the UK government's climate strategy was extremely limited, and this suggests that, at the sub-regional borough and parish levels, there is no element of subsidiarity in climate action. Even with some

examples of collaborative activity, there is no indication that actions are being focused and coordinated to maximise impact.

4. Discussion

This research forms part of a wider on-going project on the remaking of local governance in the face of climate change, and offers an initial insight into the role and activities of multiple tiers of sub-national government, from county to micro-level government action on climate change in the UK. It sits within the policy context set by a national government which has had (so far) a highly centralised approach to climate change, with no binding targets or mandates on carbon reduction or climate action beyond the devolved nations of the UK (Scotland, Wales, Northern Ireland) [65]. Additionally, its Ten Point Plan for a Green Industrial Revolution [43] focuses primarily on top-down, techno-centric solutions. Indeed, recent submissions to the Environment Audit Committee of the House of Commons in the UK Parliament, for its inquiry into local government and net zero climate policy (July and August, 2021), emphasise the lack of a sub-national framework for net zero transition and of a long-term plan for local climate mitigation and adaptation funding. This is despite clear guidance from the Committee on Climate Change [42] and their acknowledgement that:

> '*More than half of the emissions cuts needed rely on people and businesses taking up low-carbon solutions-decisions that are made at a local and individual level*'. [42] (p. 3).

From our findings to date based on parish, town, district and county council minutes in Surrey, we would concur that there is little evidence of sub-national climate action inspired and facilitated by national government. To put it another way, there remains little clarity about what the division of labour should be between different actors in the multi-level system in relation to climate action: the UK lacks a 'climate constitution' debate and process, although there is no lack of calls for such systematic thinking and action about national–local relations for climate policy [37–45].

We suggest that climate issues need to be understood within the broader concerns and problems, as noted in Section 1 above, concerning the overall relationship between central and sub-national governments in the UK [32]: the UK has an uneasy quasi-federal system based on devolution of powers to constituent sub-nations (Scotland, Wales and Northern Ireland), whose population and economic weight are dwarfed by England. The latter sub-nation has a multi-level local government system that lacks a regional tier of government and that is a patchwork of diverse sub-regional authorities and governance networks. The system is 'polycentric' in form but in practice highly centralised in resource generation and allocation [66]; it lacks a subsidiarity approach similar to that adopted as an ideal by the European Union, in which powers are devolved to the lowest level appropriate for effective policy making depending on policy domain.

We also failed to find, so far, any examples of systematic orchestration of climate action across the levels of local governance in the county. The gaps and weaknesses in the overall framework are criticised by local government and governance actors, pointing to centralism and lack of policy coherence. Such criticisms have been reiterated in relation to the centralisation of climate policy to date, and to its lack of attention to implementation of mitigation and adaptation at sub-national scales [24,37,38,42,44]. This critique is certain to be elaborated in a forthcoming report on local government's role in net zero policy making and delivery, from the Environmental Audit Committee of the House of Commons.

Pending changes in the wake of that report and similar calls for reform, and pending the UK Government's promised action plan for net zero, which might give some clarity about multi-level climate governance, local actors in areas such as Surrey have been 'remaking' institutional arrangements in the absence of substantial central guidance and support, and in the face of limited provision of information and time-limited grants. Government has provided modelled national statistics emissions data for counties and boroughs/districts so they can understand their carbon footprint but offered no target other than the national, legally binding, 2050 net zero goal [67]. As with Howarth [38], we found the primary focus of sub-county activity to be focused on mitigation actions only.

The UK Parliament's declaration of a climate emergency, whilst world leading and dramatic, did not create a legally binding commitment to comply or act, at any level of government. However, this action, and the accompanying publicity and activism, did seem to help prompt autonomous action at the local scale: in our research, we observe declarations of climate emergencies at multiple levels of sub-national government in Surrey, as a result of local decision making (see also [38]). Indeed, many of these were supported by the actions of local 'wilful actors'. Our case study reveals considerable action being undertaken at local and micro-local levels, with many town and parish councils independently taking steps to support climate goals. The analysis suggests, however, that many of these are working in isolation with little guidance on how they should act.

We also find only limited flows of information downwards across levels of government and even less flowing upwards from a parish level. Overall, sub-national actors such as the county council and districts and boroughs are critical of the lack of 'visibility' of climate guidance, resources and coherence above them in the governance hierarchy; and for micro-level actors the actions, division of labour and resources for climate policy are largely 'invisible' at the upper local scale as well as the national one. Problems of incoherence and lack of orchestration are thus repeated from one scale of relationships (national/county) to the others (county/district/micro-local), and independent action at the local scales is constrained by resources and capabilities.

All this is consistent with our analysis above of the nature of multi-level climate governance in the UK as a case of local institutional 'remaking' [48], in the face of both a policy imperative and a policy vacuum as to how climate policy is to be developed and implemented at sub-national scales. The remaking of existing processes and institutions and the creation of new ones are reflections both of urgency and local commitment on the one hand, and frustration on the other. As noted earlier, local climate governance in the current UK framework is largely *improvisatory and compensatory*, and with that comes risks of incoherence, ineffectual action and confusion. In particular, micro-local action, in the absence of clarity about tasks and resources, risks being ineffective and fragmented, for all the enthusiasm and energy we have detected in fieldwork in parish and town council networks.

Whilst there are nascent elements of promising multi-level climate governance, such as borough councils co-ordinating with parishes, town councils setting up funds (Godalming and Haslemere) and NGOs and business collaborating at a county level, current governance appears to be closer to the fragmented typology created by Pahl-Wostl and Knieper [68] which lacks the ordering and co-ordination [69] and distribution of power [68] needed for effective multi-level or polycentric governance.

In the absence of a clear and coherent division of policy labour within a multi-level framework, potential for action at county, district/borough and micro-local level is not likely to be harnessed and realised effectively and consistently. In particular, our research, so far, suggests that the county level and the borough are more active than the parish and town councils. At the micro-local level, our analysis suggests that this may be an issue of scale, but this needs to be investigated further as funding, capacity, regulatory alignment and other factors are also likely to play a role. We may also be observing differences between urban and rural interests and needs. Further work may give insights into what would constitute the most effective set of roles for micro-local actors and also the *limits* to their climate activities.

5. Conclusions

Climate governance—the development and implementation of coherent and effective policy for decarbonisation and adaptation by government actors and their governance partners at all levels from national to micro-local—is an emerging and, so far, ill-specified set of institutional forms in the UK. We have set out the context in which local climate governance arrangements are evolving in the UK, and related them to major themes in the literature on climate, multi-level governance and polycentrism.

It may be that the issues we have identified in local climate governance in our case study area have much wider resonance internationally, notably in similarly centralized states where local and regional actors lack adequate resources, recognition and clarity of division of labour concerning climate action. These issues raise questions of major concern for our theoretical and practical understandings of urgent and ambitious climate action within a multi-level governance framework. What would constitute an effective division of labour for climate action between national and sub-national levels? How can this be related to wider frameworks of governance for sustainability? What is the role in climate action of the sub-regional levels of governance, from (in the UK context) county to micro-local actors? What processes would generate a more effective orchestration of action? Additionally, what are the features of sub-national climate action in the absence of a systematic attempt at answering these questions by policy makers?

Whilst this study has been able to identify micro-level action, begin to understand some of the underlying causes and consider these within current theoretical approaches, it does have limitations. The use of council minutes offers only an imperfect insight into the motivations behind action, are likely to offer a level of bias within the reporting, and fail to capture all the work being undertaken at this sub-national level. It is also inherent within a case study approach that it remains difficult to generalize the findings beyond the area of study. Further research is needed to address the questions raised above. Our on-going research in the English county of Surrey indicates that a process of improvisatory and compensatory innovation is under way in climate governance at the level of the county, districts and boroughs, and among the micro-level bodies at the parish and town scales. This is consistent with Patterson's [48] analysis of the need for a 'remaking' of institutions for climate action in a context of wider institutional failure and inadequacy. We suggest that a wider programme of sub-regional research will shed further light on this uneven process across the UK, as local government bodies and their partners respond to the climate crisis in the absence of a clear multi-level 'settlement' that enables truly effective divisions of mitigation and adaption labour, and an approach to multi-level governance that plays to the strengths of each level of governance actors.

Author Contributions: All authors have been involved in the conceptualisation, research, development, writing and reviewing of this paper. All authors have read and agreed to the published version of the manuscript.

Funding: The authors gratefully acknowledge the support from the UK Economic and Social Research Council through the Place-Based Climate Action Network (P-CAN) (Ref. ES/S008381/1).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and the Ethical Review self-assessment process of the University of Surrey was followed.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Acknowledgments: We gratefully acknowledge financial support from the UK's Economic and Social Research Council (ESRC) through the Place- based Climate Action Network (PCAN).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Multi-level government in Surrey: the case of Waverley district.

Type of Council	Name of Council	Area Covered (km^2)	No. of People Represented	Primary Nature of Area	Ranking by Size of Population (TC = Town Council, PC = Parish Council)
County Council	Surrey	166.3	1,132,400	Urban/rural	
Borough Council	Waverley	345.2	12,752	Urban/rural	

Table A1. *Cont.*

Type of Council	Name of Council	Area Covered (km^2)	No. of People Represented	Primary Nature of Area	Ranking by Size of Population (TC = Town Council, PC = Parish Council)
Town Council	Farnham	36.52	39,488	Urban	TC1
	Godalming	9.68	21,804	Urban	TC2
	Hazelmere	23.27	16,826	Urban	TC3
Parish Council	Alford	15.1	1059	Rural	PC11
	Bramley	18.87	3559	Rural	PC3
	Busbridge	9.92	779	Rural	PC14
	Chiddingfold	28.18	2960	Rural	PC5
	Churt	4.68	1202	Rural	PC10
	Cranleigh	32.78	11,241	Urban/rural	PC1
	Dockenfield	2.73	399	Rural	PC16
	Dunsford	9.89	1606	Rural	PC9
	Elstead	11.04	2557	Rural	PC6
	Ewhurst with Ellens Green	23.79	2391	Rural	PC7
	Frensham	16.21	1689	Rural	PC8
	Hambledon	11.11	805	Rural	PC12
	Hascombe	5.25	307	Rural	PC17
	Peper Harrow	5.34	185	Rural	PC18
	Thursley	19.85	651	Rural	PC15
	Tilford	9.87	799	Rural	PC13
	Witley	27.76	8130	Rural	PC2
	Wonersh	17.78	3412	Rural	PC4

Appendix B

Table A2. NVIVO Coding utilised for the review of council minutes.

Deductive Codes	Minutes—Council Meetings
Climate Action Taken	All activity recorded—includes development of plans and strategy, working group set up, local action to support carbon reduction or co-benefits (note further inductive coding to identify specific actions)
Co-benefits	Additional benefits derived from taking climate change action
Collaboration	Choosing to work with others; to support or learn from climate change goals
Communication	Providing information to the public or acknowledging community engagement
Finance	Climate change and budget requirements, addressing climate change in budgets, local funding
Orchestration	Direct management of multi-level governance for climate change
Sub-national Surrey knowledge	How knowledge is being acquired by local government actors

Table A2. *Cont.*

Deductive Codes	Minutes—Council Meetings
Subsidiarity	allocation of roles to sub-national government bodies to support global or national climate change goals
Urban-rural	Note or comment on different status between areas
Wilful Actors	Individuals who are challenging the status quo or driving climate action

Appendix C

Table A3. Acknowledgement of the source of council minutes.

Type of Council	Name of Council	Online Source of Council Minutes
County Council	Surrey	https://mycouncil.surreycc.gov.uk/ieListMeetings.aspx?CId=121&Year=0
Borough Council	Waverley	https://modgov.waverley.gov.uk/ieListMeetings.aspx?CId=130&Year=0
Town Council	Farnham	https://democracy.farnham.gov.uk/ieListMeetings.aspx?CId=1137&Year=0
	Godalming	https://godalming-tc.gov.uk/agendas-minutes/agendas-minutes-2020/
	Hazelmere	https://haslemeretc.org/meetings/ Archive: https://haslemeretc.org/categories/minutes-archives/
Parish Council	Alford	http://alfoldparishcouncil.co.uk/index.php/minutes/
	Bramley	https://www.bramleyparish.co.uk/community/bramley-parish-council-15042/meeting-minutes/#
	Busbridge	https://www.busbridgeparishcouncil.org.uk/meetings
	Chiddingfold	https://chiddingfold-pc.gov.uk/parish-council-minutes/
	Churt	https://www.churt.org/council-agendas-and-minutes
	Cranleigh	https://www.cranleigh-pc.gov.uk/Full_Council_15104.aspx
	Dockenfield	http://www.dockenfieldpc.org.uk/meetings.html
	Dunsford	https://dunsfoldparishcouncil.gov.uk/document-category/minutes/
	Elstead	https://elsteadvillage.co.uk/parish-council-meetings/
	Ewhurst with Ellens Green	https://www.ewhurstellensgreen-pc.gov.uk/agendas--minutes.html
	Frensham	https://www.frensham-pc.gov.uk/Full_Council_30315.aspx
	Hambledon	https://www.hambledon-pc.gov.uk/Parish_Council/Parish_Council_Meetings.aspx
	Hascombe	https://www.hascombeparishcouncil.co.uk/new-page
	Peper Harrow	Not available online—no website
	Thursley	https://www.thursley-pc.gov.uk/Minutes.aspx
	Tilford	http://www.tilfordpc.org.uk/meetings.php?id=15
	Witley	https://witley-pc.gov.uk/parish-council/meetings-minutes/
	Wonersh	https://www.wonershparish.org/our-meetings

References

1. Abbott, K.W.; Bernstein, S.; Janzwood, A. Orchestration. In *Architectures of Earth System Governance: Institutional Complexity and Structural Transformation*; Biermann, F., Kim, R., Eds.; Cambridge University Press: Cambridge, UK, 2020; pp. 233–253.
2. Bulkeley, H. *Accomplishing Climate Governance*; Cambridge University Press: Cambridge, UK, 2016.
3. Dubash, N.K. Varieties of climate governance: The emergence and functioning of climate institutions. *Environ. Politics* **2021**, *30*, 1–25. [CrossRef]
4. Hamman, P. (Ed.) Rethinking Hierarchy in Sustainability Governance: A Literature Review. In *Sustainability Governance and Hierarchy*; Routledge: Abingdon, UK, 2019.
5. Harris, P.G. *Pathologies of Climate Governance: International Relations, National Politics and Human Nature*; Cambridge University Press: Cambridge, UK, 2021.
6. Heinen, D.; Arlati, A.; Knieling, J. Five dimensions of climate governance: A framework for empirical research based on polycentric and multi-level governance perspectives. *Environ. Policy Gov.* **2021**, *31*. [CrossRef]
7. Wurzel, R.K.; Liefferink, D.; Torney, D. Pioneers, leaders and followers in multilevel and polycentric climate governance. *Environ. Politics* **2018**, *28*, 1–21. [CrossRef]
8. Adger, W.N.; Jordan, A. (Eds.) *Governing Sustainability*; Cambridge University Press: Cambridge, UK, 2009.
9. Bäckstrand, K.; Lövbrand, E. (Eds.) *Research Handbook on Climate Governance*; Edward Elgar Publishing: Cheltenham, UK, 2015.
10. Biermann, F. *Earth System Governance*; MIT Press: Cambridge, MA, USA, 2014.
11. Bulkeley, H.; Newell, P. *Governing Climate Change*; Routledge: Abingdon, UK, 2015.
12. Galaz, V. *Global Environmental Governance, Technology and Politics*; Edward Elgar Publishing: Cheltenham, UK, 2014.
13. Jordan, A.; Huitema, D.; Van Asselt, H.; Forster, J. *Governing Climate Change: Polycentricity in Action?* Cambridge University Press: Cambridge, UK, 2018.
14. Lieven, A. *Climate Change and the Nation State*; Penguin: London, UK, 2021.
15. Betsill, M.M.; Bulkeley, H. Cities and the Multilevel Governance of Global Climate Change. *Glob. Gov.* **2006**, *12*, 141–160. [CrossRef]
16. Bulkeley, H.; Betsill, M.M. Revisiting the urban politics of climate change. *Environ. Politics* **2013**, *22*, 136–154. [CrossRef]
17. Chatterton, P. *Unlocking Sustainable Cities*; Pluto Press: London, UK, 2018.
18. ICLEI. *ICLEI in the Urban Era: Our Vision for a Sustainable Urban World*; ICLEI: Bonn, Germany, 2021.
19. Lee, T. *Global Cities and Climate Change*; Routledge: New York, NY, USA, 2016.
20. Low, S.; Boettcher, M. Delaying Decarbonization: Climate Governmentalities and Sociotechnical Strategies from Copenhagen to Paris. *Earth Syst. Gov.* **2020**, *5*, 100073. [CrossRef]
21. Moloney, S.; Hartmut, H.; Granberg, M. (Eds.) *Local Action on Climate Change: Opportunities and Constraints*; Routledge: Abingdon, UK, 2018.
22. Thorpe, D. *"One Planet" Cities*; Earthscan/Routledge: Abingdon, UK, 2019.
23. Vedeld, T.; Hofstad, H.; Solli, H.; Hanssen, G.S. Polycentric urban climate governance: Creating synergies between integrative and interactive governance in Oslo. *Environ. Policy Gov.* **2021**, *31*, 347–360. [CrossRef]
24. Howarth, C.; Lane, M.; Slevin, A. (Eds.) *Addressing the Climate Crisis*; Palgrave Macmillan: London, UK, 2022.
25. Parry, I.; Black, S.; Vernon, N. *Still Not Getting Energy Prices Right: A Global and Country Update of Fossil Fuel Subsidies*; IMF: Washington, DC, USA, 2021.
26. Stoddard, I.; Anderson, K.; Capstick, S.; Carton, W.; Depledge, J.; Facer, K.; Gough, C.; Hache, F.; Hoolohan, C.; Hultman, M.; et al. Three Decades of Climate Mitigation: Why Haven't We Bent the Global Emissions Curve? *Annu. Rev. Environ. Resour.* **2021**, *46*, 653–689. [CrossRef]
27. Ostrom, E. Polycentric systems for coping with collective action and global environmental change. *Glob. Environ. Chang.* **2010**, *20*, 550–557. [CrossRef]
28. Wittmayer, J.M.; Van Steenbergen, F.; Rok, A.; Roorda, C. Governing sustainability: A dialogue between Local Agenda 21 and transition management. *Local Environ.* **2015**, *21*, 939–955. [CrossRef]
29. Copus, C.; Roberts, M.; Wall, R. *Local Government in England: Centralisation, Autonomy and Control*; Palgrave Macmillan: London, UK, 2017.
30. Stanton, J. *Democratic Sustainability in a New Era of Localism*; Routledge: Abingdon, UK, 2014.
31. Harris, T.; Hodge, L.; Phillips, D. *English Local Government Funding: Trends and Challenges in 2019 and Beyond*; Institute of Fiscal Studies: London, UK, 2019.
32. Gray, M.; Barford, A. The depths of the cuts: The uneven geography of local government austerity. *Camb. J. Reg. Econ. Soc.* **2018**, *11*, 541–563. [CrossRef]
33. Fenwick, J. The problem of sub-national governance in England. *Public Money Manag.* **2014**, *35*, 7–14. [CrossRef]
34. Shutt, J.; Liddle, J. Are Combined Authorities in England strategic and fit for purpose? *Local Econ. J. Local Econ. Policy Unit* **2019**, *34*, 196–207. [CrossRef]
35. National Audit Office. *Local Government and Net Zero in England, National Audit Office*; HM Government: London, UK, 2021.
36. Ogden, K.; Phillips, D.; Sion, C. What's happened and what's next for councils? In *The IFS Green Budget*; Institute for Fiscal Studies: London, UK, 2021.

37. Green Alliance. The Local Climate Challenge: A New Partnership Approach. 2020. Available online: https://green-alliance.org.uk/the_local_climate_challenge.php (accessed on 14 September 2021).
38. Howarth, C.; Barry, J.; Dyson, J.; Fankhauser, S.; Gouldson, A.; Lock, K.; Owen, A.; Robins, N. *Trends in Local Climate Action in the UK: A Report by the Place-Based Climate Action Network (PCAN)*; PCAN: London, UK, 2021.
39. County Councils Network. Rising to the Climate Challenge: The Role of County Councils in Delivering Net Zero 2021. Available online: https://www.countycouncilsnetwork.org.uk/the-government-risks-undermining-its-net-zero-target-by-focusing-on-cities-instead-of-englands-counties-report-warns/ (accessed on 30 September 2021).
40. UK100. Net Zero Local Leadership Communique 2021. Available online: https://www.uk100.org/publications/net-zero-local-leadership-communique-delivering-net-zero-uk (accessed on 15 September 2021).
41. Committee on Climate Change. Net Zero The UK's Contribution to Stopping Global Warming. 2019. Available online: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/ (accessed on 17 July 2021).
42. Committee on Climate Change. Policies for the Sixth Carbon Budget and Net Zero. London, UK. 2020. Available online: https://www.theccc.org.uk/wp-content/uploads/2020/12/Policies-for-the-Sixth-Carbon-Budget-and-Net-Zero.pdf (accessed on 22 August 2021).
43. Committee on Climate Change. *Joint Recommendations: 2021 Report to Parliament*; Climate Change Committee: London, UK, 2021. Available online: https://www.theccc.org.uk/wp-content/uploads/2021/06/CCC-Joint-Recommendations-2021-Report-to-Parliament.pdf (accessed on 17 August 2021).
44. House of Commons Public Accounts Committee. Achieving Net Zero 2021. London, UK. Available online: https://publications.parliament.uk/pa/cm5801/cmselect/cmpubacc/935/93502.htm (accessed on 20 September 2021).
45. Sasse, T.; Rutter, J.; Shepheard, M.; Norris, E. *Net Zero: How Government Can Meet Its Climate Change Target*; Institute for Government: London, UK, 2020.
46. BEIS. The Ten Point Plan for a Green Industrial Revolution. London, UK. 2020. Available online: https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution (accessed on 20 September 2021).
47. Arroyo, V. From Paris to Pittsburgh: US State and Local Leadership in an Era of Trump. *Geo. Envtl. L. Rev.* **2018**, *31*, 433.
48. Patterson, J.J. *Remaking Political Institutions: Climate Change and Beyond. Elements in Earth System Governance*; Cambridge University Press: Cambridge, UK, 2020.
49. Bäckstrand, K.; Kuyper, J.W. The democratic legitimacy of orchestration: The UNFCCC, non-state actors, and transnational climate governance. *Environ. Politics* **2017**, *26*, 764–788. [CrossRef]
50. ICLEI. *Local Sustainability: Taking Stock and Moving Forward*; ICLEI: Bonn, Germany, 2012.
51. Barber, B. *If Mayors Ruled The World*; Yale University Press: New Haven, CT, USA, 2013.
52. Ostrom, E. *Governing the Commons: The Evolution of Institutions for Collective Action*; Cambridge University Press: Cambridge, UK, 1990.
53. Ostrom, E. A Polycentric Approach for Coping with Climate Change. *Ann. Econ. Financ.* **2014**, *15*, 97–134.
54. Yin, R.K. *Case Study Research: Design and Methods*, 1st ed.; SAGE Publications Ltd.: London, UK, 2009.
55. Legatum Institute. The United Kingdom Prosperity Index. London, UK. 2021. Available online: https://li.com/reports/uk-prosperity-index-2021/ (accessed on 17 August 2021).
56. ONS. 2011 Census: Usual Resident Population and Population Density, Local Authorities in the United Kingdom. Available online: https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/2011censuspopulationandhouseholdestimatesfortheunitedkingdom/r01ukrttable2v2_tcm77-292364.xls (accessed on 23 June 2021).
57. Russell, E.; Christie, I.; Murphy, R. *Surrey Carbon Baseline Report*; Surrey Climate Commission: Guildford, UK, 2021. Available online: https://www.surreyclimate.org.uk/sites/default/files/SvCComm%20Baseline%20Report%20-%20Final%20Version%2023.4.21.pdf (accessed on 15 August 2021).
58. SCC Agenda and Minutes Council-Tuesday, 9 July 2019 10.00 Am. Available online: https://mycouncil.surreycc.gov.uk/ieListDocuments.aspx?CId=121&MId=6659&Ver=4 (accessed on 17 June 2021).
59. ONS. Estimates of the Population for the UK, England and Wales, Scotland and Northern Ireland. 2021. Available online: https://www.ons.gov.uk/peoplepopulationandcommuni-ty/populationandmigration/populationestima-tes/datasets/populationestimatesforukenglandandwalesscotlandandnorthernire-land (accessed on 13 July 2021).
60. ONS. Parish Population Estimates for Mid-2001 to Mid-2019 Based on Best-Fitting of Output Areas to Parishes. 2021. Available online: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/adhocs/12324parishpopulationestimatesformid2001tomid2019basedonbestfittingofoutputareastoparishes (accessed on 13 July 2021).
61. DCLG. Transparency Code for Smaller Authorities 2014. Available online: https://www.gov.uk/government/publications/transparency-code-for-smaller-authorities (accessed on 23 August 2021).
62. HM Government. The Openness of Local Government Bodies Regulations 2014. UK. 2014. Available online: https://www.legislation.gov.uk/uksi/2014/2095/contents/made (accessed on 24 August 2021).
63. Childs, M. 20 Actions Parish and Town Councils Can Take on the Climate and Nature Emergency. Available online: https://policy.friendsoftheearth.uk/reports/20-actions-parish-and-town-councils-can-take-climate-and-nature-emergency (accessed on 14 July 2021).

64. University of Exeter. Centre for Sustainable Energy. *Online Tool Measures Community Carbon Footprint*. Available online: https://www.exeter.ac.uk/sustainability/newsandevents/archive/title_850346_en.html (accessed on 18 March 2021).
65. The UK Government Climate Change Act 2008. UK. 2008. Available online: https://www.legislation.gov.uk/ukpga/2008/27/contents (accessed on 19 September 2021).
66. Abbott, K.W.; Genschel, P.; Snidal, D.; Zangl, B. *International Organizations as Orchestrators*; Cambridge University Press: Cambridge, UK, 2015.
67. BEIS. UK Becomes First Major Economy to Pass Net Zero Emissions Law. Available online: https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law (accessed on 1 August 2021).
68. Pahl-Wostl, C.; Knieper, C. The Capacity of Water Governance to Deal with the Climate Change Adaptation Chal-lenge: Using Fuzzy Set Qualitative Comparative Analysis to Distinguish between Polycentric, Fragmented and Centralized Regimes. *Glob. Environ. Chang.* **2014**, *29*, 139–154. [CrossRef]
69. Abbott, K.W. Orchestration. Strategic Ordering in Polycentric Governance. In *Governing Climate Change: Polycentricity in Action?* Jordan, A., Huitema, D., Van Asselt, H., Forster, J., Eds.; Cambridge University Press: Cambridge, UK, 2018.

sustainability

MDPI

Article

Assessing City Governance for Low-Carbon Mobility in London

Paul Drummond

UCL Institute for Sustainable Resources, Central House, London WC1H 0NN, UK; p.drummond@ucl.ac.uk

Abstract: City-level decisions are crucial for delivering a low carbon transition, particularly as urban population dynamics and environments change in response to the COVID-19 pandemic. Ensuring appropriate governance structures, mechanisms and resources to facilitate these decisions is therefore essential. Based on a systematic literature review by van der Heijden (2019), this paper develops a simple framework to assess the state of ten enabling factors for effective urban climate governance, and applies it to low-carbon passenger mobility in London. Drawing on documentary evidence and a series of semi-structured expert interviews, it finds that London's city authorities have a strong capacity for autonomy, stakeholder participation, local leadership and coordination on climate action and mobility, of which they make extensive use. The national legal and political framework remains broadly supportive following the UK's departure from the EU, but multi-level co-ordination is thin, and funding issues have intensified conflict over political jurisdiction since the pandemic began. Spatial variation in urban form and infrastructure, coupled with dual-layer city administration, complicate the socio-political landscape and drive for climate action in mobility.

Keywords: climate change; local government; climate governance; urban transport

Citation: Drummond, P. Assessing City Governance for Low-Carbon Mobility in London. *Sustainability* **2021**, *13*, 2480. https://doi.org/10.3390/su13052480

Academic Editor: David Tyfield

Received: 1 February 2021
Accepted: 23 February 2021
Published: 25 February 2021

1. Introduction

Following existing nationally determined contributions (NDCs) under the Paris Agreement, warming is projected to reach 2.6 °C by the end of the century, with a lack of practical implementation increasing this to 2.9 °C [1]. Although this represents progress, these values remain well above stated goals. In the absence of sufficient action by national decision makers, attention has been increasingly turning to sub-national actors to lead the low-carbon transition, and in particular, those in city governance. This sits alongside other areas of environmental concern and human development in which city-level governance is central, such as tackling air pollution and delivering Sustainable Development Goal 11.

In recent years, a wide literature examining urban climate governance has emerged, with insights across four key research themes systematically reviewed and synthesised by van der Heijden (2019) [2]. One theme concerns the factors that enable effective urban climate governance, from which the author derived a list of eight primary, interacting elements. This paper develops a framework to assess the state of an expanded list of enabling factors in cities and applies it to London, with a focus on the transition to low-carbon passenger mobility in the wake of the COVID-19 pandemic.

Section 2 first presents a brief overview of the enabling factors presented by van der Heijden (2019) [2] and the wider literature, before describing the assessment framework derived from them, and the method used to apply it. Section 3 presents the result of the application of this framework to low-carbon passenger mobility in London. Section 4 concludes.

2. Materials and Methods

2.1. Literature Review

This paper draws (and expands) on eight "enabling factors" for effective urban climate governance derived and synthesised by van der Heijden (2019) [2] from his review of 260 articles published between 2009 and 2018. These factors are briefly summarised in

Figure 1 (dark green boxes). Van der Heijden (2019) [2] suggests no hierarchy between these factors, and a lack of distinct boundaries, with close interrelation between them. He also notes that they are not exhaustive. For this paper, I consider two additional factors, to provide a broader foundation for analysis (light green boxes in Figure 1).

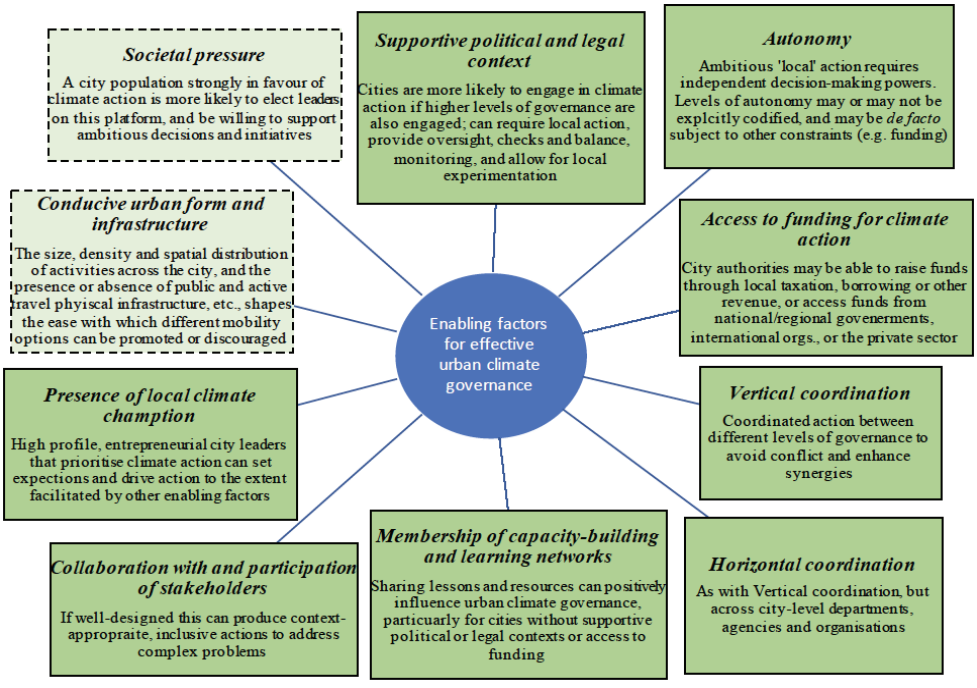


Figure 1. Expanded list of enabling factors for effective climate governance.

The first additional factor is *conducive urban form and infrastructure*. The form of the urban environment strongly influences resource consumption and environmental impact; e.g., large, unicentric cities with low population densities, are likely to have a higher per capita footprint than smaller, polycentric and more densely populated cities—particularly with regard to urban mobility [3–5]. Inherited infrastructure such as metro lines and pavements, or their absence, may also raise or reduce hurdles to different behaviours. The form of a city may thus shape the challenge it faces to deliver decarbonisation, and mediate the transition to achieve it [6]. The second additional factor is *societal pressure*; if the city population is in favour of climate action, measures are more likely to be proposed and successfully introduced. This factor was used by van der Heijden, Luckmann and Cherkasheva—in addition to the original eight—to guide their assessment of the state of urban climate governance in Moscow and Saint Petersburg [7].

Frameworks for assessing the state of city-level governance for other environmental concerns (such as water and waste), for assessing particular strategies for urban climate action, or for climate change adaptation and resilience, have all been developed and applied in the literature (e.g., [8–10]). However, a framework to assess the broad state of urban governance for greenhouse gas (GHG) mitigation, building on a thorough assessment of critical factors, has yet to be developed.

2.2. Assessment Framework

The assessment framework developed and employed by this paper qualitatively scores each of the ten enabling factors presented above, through two inter-related lenses. The first lens assesses the Capacity of a city to take advantage of the enabling factors, and reflects circumstances both within and outside its control. The second lens assesses the extent to which Action has been taken by city authorities to exploit this capacity to drive the transition. Each enabling factor is awarded a Capacity score using a straight-forward four point scale of "weak", "moderately weak", "moderately strong" and "strong", following Sovacool and Van de Graaf [11]. Seven of the ten factors are also provided an Action score with the same scale, with the remaining three—*Supportive political and legal context*, *Conducive urban form and infrastructure* and *Societal pressure*—considered contextual factors, within which the city authorities must operate but cannot easily influence or adjust (at least in the short term). Assigning an Action score to these factors would thus not be appropriate. Table 1 presents the broad criteria applicable to the scores for each lens, for each factor.

Table 1. Score descriptors for enabling factors and assessment lenses.

Enabling Factor		Weak	Moderately Weak	Moderately Strong	Strong
Supportive political and legal context	Capacity	No or limited political, policy or legal support from higher levels of governance.		Clear political, policy and legal support from higher levels of governance	
	Action	*Not applicable*			
Autonomy	Capacity	No or limited ability to introduce substantive policy strategy, decisions and instruments that go beyond those introduced at higher levels of governance, and ability to raise and manage own resources to implement them		Reasonable or extensive ability to introduce substantive policy strategy, mechanisms and instruments that go beyond those introduced at higher levels of governance, and ability to raise and manage own resources to implement them	
	Action	No or limited action has been taken to make use of the autonomy available		Reasonable or extensive action has been taken to make use of the autonomy available	
Access to Funding for Climate Action	Capacity	No or limited ability to use own funds for climate action (either granted or self-generated from e.g., taxation), regardless of level of discretion over how such funds may be used, and/or limited ability to access external funds (due to eligibility, competitiveness, etc.)		Reasonable or extensive ability to use own funds for climate action (either granted or self-generated from e.g., taxation), regardless of level of discretion over how such funds may be used, and/or extensive ability to access external funds	
	Action	No or limited attempts have been made to raise or use funds available for climate action		Reasonable or extensive attempts have been made to raise or use funds available for climate action	
Vertical Coordination	Capacity	No or limited formal or informal processes or actors at any governance level to facilitate vertical co-ordination of climate action		Some or several, clear, formal or informal processes, or dedicated body at the national level responsible for vertical co-ordination of climate action, inclusive of both city and supranational action (if relevant)	
	Action	No or limited use of or attention paid to processes or actors at any governance level for vertical co-ordination of climate action		Reasonable or extensive use of or attention paid to processes or actors at any governance level for vertical co-ordination of climate action	

Table 1. *Cont.*

Enabling Factor		Weak	Moderately Weak	Moderately Strong	Strong
Horizontal Coordination	Capacity	No or limited formal or informal processes for horizontal coordination of climate action within the city		Some or several, clear, formal or informal processes with wide scope, or a central co-ordination body, with high prominence or wide remit, for horizontal coordination of climate action within the city	
	Action	No or limited use of or attention paid to processes or bodies for horizontal co-ordination of climate action		Reasonable or extensive use of or attention paid to processes or bodies for horizontal co-ordination of climate action	
Membership of Capacity-building and Learning Networks	Capacity	No or limited membership of relevant capacity building and learning networks, that the city authorities are eligible to join		Membership of many or most relevant capacity building and learning networks, that the city authorities are eligible to join	
	Action	No or limited engagement with the relevant capacity building and learning networks in which the city is involved		Reasonable or extensive engagement with the relevant capacity building and learning networks in which the city is involved	
Collaboration with and Participation of Stakeholders	Capacity	No or limited formal or informal process for consultation or collaboration with stakeholders and/or no or limited processes to encourage collaboration within and between different stakeholder groups		Some or several, clear, formal or informal process for consultation or collaboration with stakeholders and/or no or limited processes to encourage collaboration within and between different stakeholder groups	
	Action	No or limited use of formal or informal stakeholder consultation or collaboration processes, with no or limited reflection of their outcomes in policy decisions, or reflection of the interests of a narrow range of stakeholders		Reasonable or extensive use of formal or informal stakeholder consultation or collaboration processes, with reasonable or extensive reflection of their outcomes in policy decisions, representing interests of a wide range of stakeholders	
Presence of Local Climate Champion	Capacity	No clear city authority figurehead, or with no or limited public profile and formal or informal power		Clear city authority figurehead (mayor or equivalent) with high profile and reasonable or extensive power within the bounds of city autonomy	
	Action	Mayor or equivalent is hostile or indifferent to climate action		Mayor or equivalent is reasonably or clearly supportive of ambitious climate action	
Conducive Urban form and infrastructure	Capacity	The form of the city, its infrastructure and environs is generally a hinderance to the adoption of key low-carbon technologies and behaviours required for strong climate action		The form of the city, its infrastructure and environs is generally well suited to the adoption of key low-carbon technologies and behaviours required for strong climate action	
	Action	*Not applicable*			
Societal Pressure	Capacity	Residents of the city (individuals and businesses) are generally hostile or indifferent to climate action		Residents of the city (individuals and businesses) generally support or demand strong climate action	
	Action	*Not applicable*			

2.3. Method

The evidence for ascribing scores is drawn from a range of documentary evidence (e.g., legislation, publications by city, national and other authorities, independent reports), and from a series of expert interviews. The interviews took place in September 2020, and were semi-structured around eleven guiding questions to allow free-ranging discussion. The guiding questions focused on each of the enabling factors, and on the role and impact

of the COVID-19 pandemic and measures to mitigate it. The questions are presented in Appendix A. Interviewee responses are anonymised, to allow participants free expression regardless of affiliation.

Table 2 describes the type of interviewees, and assigns each a code. In Section 3, specific quotes or insights from the interviewees are labelled using these codes. For clarity, "City authority" refers to bodies within the Greater London Authority or London boroughs, or their representatives.

Table 2. Coded list of expert interviewees.

Interviewee Number	Interviewee Type
LI-1	City authority
LI-2	London and/or transport-focused NGO
LI-3	City authority
LI-4	London and/or transport-focused NGO
LI-5	City authority
LI-6	London and/or transport-focused NGO
LI-7	London and/or transport-focused NGO
LI-8	Academic

Note: NGO = Non-governmental organisation.

I apply the assessment framework to the governance of low-carbon passenger mobility in London with respect to tackling CO_2 emissions. This includes any mode of land-based passenger transport in the city, and excludes journeys that begin or end substantially outside its boundaries (e.g., intercity road, rail and aviation). Water/marine transport are excluded. Governance factors that target other environmental issues associated with passenger mobility, such as local air pollution, are included only where there is a substantial and clearly positive overlap with CO_2 emissions. Scores for each enabling factor and lens are given in parentheses in section headings.

3. Results

Greater London (London, hereafter) covers 1569 km^2, has a population of 9 million, and produces a quarter of the UK's GDP [12]. A further 1 million people regularly commuted to London to work between 2015 and 2017 [13]. Transport accounted for around a quarter of London's CO_2 emissions in 2017, with private cars responsible for nearly half of this. Private cars, public transport and active transport each accounted for around a third of daily trips in 2018 (Figure 2).

At the height of COVID-19 restrictions in April 2020, road traffic reduced to below 50% of usual levels, whilst bus and London Underground travel decreased over 80% and 95%, respectively. Although by October 2020 road traffic had recovered, bus and Underground travel remained at over 40% and 60% below usual levels. Weekday cycling remained largely stable throughout the pandemic, with increased activity at weekends [16].

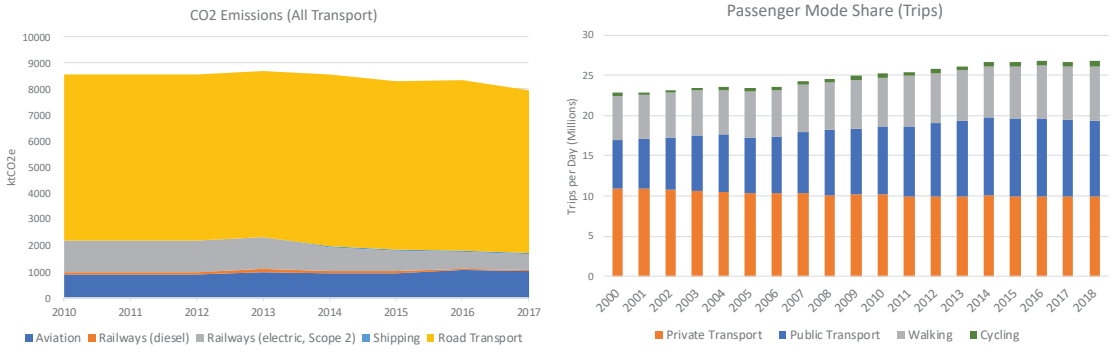


Figure 2. (**a**) CO_2 emissions from all transport in London; (**b**) Annual average share of passenger transport mode by trip in London (Data sources: [14,15]).

3.1. Supportive Political and Legal Context (Moderately Strong)

As its capital city, London is within the jurisdiction of the UK government. The UK's 2008 Climate Change Act required the government to reduce territorial GHG emissions by at least 80% below 1990 levels by 2050. In 2019, this was increased to net-zero emissions. The Act also introduces "carbon budgets"; successive five-yearly "caps" on emissions that reduce over time. The government must publish strategies for achieving these budgets. The most recent of these is the Clean Growth Strategy (CGS), published in October 2017 (prior to the net-zero target), which stated that "almost every car and van will need to be zero emission by 2050" [17] (p. 85) In November 2020, the government announced that that a ban on new petrol and diesel cars will take effect from 2030, and hybrids from 2035 [18].

Until 31st December 2020, the UK was subject to the political and legal framework of the European Union (EU), after which all EU legislation remains, or was translated into, UK domestic law. At the time of writing in early 2021, no deviations from such legislation have been introduced. Key EU requirements include fleet-average CO_2 intensity regulations on passenger cars and point-of-sale labels presenting information on fuel consumption, CO_2 emissions and running costs. In the UK, new cars are also subject to purchase taxes according to CO_2 intensity (under vehicle excise duty—VED), ranging from zero (for zero-emission vehicles), to GBP 2175. Thereafter, annual ownership taxes are zero for electric vehicles (EVs), and GBP 150 for gasoline and diesel cars [19]. Purchase subsidies of 35% (up to GBP 3000) for cars with CO_2 emissions < 50 g CO_2/km, and GBP 7500 for zero-emission capable (ZEC) taxis, are available [20]. Excise (fuel) duty comprises around half total retail prices for gasoline and diesel, although the rate has been frozen in nominal terms since 2010. The reported average CO_2 intensity of all new cars in the UK decreased by 17% in 2009–2019 [21], although this is subject to widely reported discrepancies between emissions in test and real-world conditions [22].

The government seeks to "develop one of the best electric vehicle infrastructures in the world" [23], with a policy framework that includes capital grants for domestic, on-street and workplace charging installations [24]. The principal instrument for low-carbon public transport is the Ultra-Low Emission Bus (ULEB) Scheme, a GBP 48 million fund for local authorities to purchase ULEBs and infrastructure. A Cycling and Walking Investment Strategy published in 2017 committed GBP 1.2 billion to associated infrastructure and initiatives to 2021 [25], although a report to Parliament in February 2020 concluded that although committed funding had since doubled to GBP 2.4bn, progress was insufficient [26]. In July 2020, the Government committed an additional GBP 2bn over 2020–2025, setting a target for walking and cycling to be "the natural first choice for many journeys with half of all journeys in towns and cities being cycled or walked by 2030" [27] (p. 12).

The UK's political and legal framework is broadly supportive of low-carbon mobility, however, it "doesn't seem as if all the policies are following through" (LI-5) to achieve stated goals, with "decarbonisation not coherently structured through all policies" (LI-8). Policy on passenger vehicles is generally positive (LI-1 and 6), particularly with the 2030 ban on new gasoline and diesel cars, but the UK is "really lacking in policy to promote active travel, and to encourage public transport use" (LI-3). LI-3, 4 and 7 highlighted that investment in public transport and active travel is dwarfed by the planned GBP 27bn investment in road infrastructure to 2025. Reflecting on the historic role of the EU, LI-8 believed that it remains "relevant through the legacy that has been created", although LI-3 felt that it provided "little more [than] strategic level commitments". LI-7 believes that "since the crisis hit, the government has talked more loudly and more assertively about walking and cycling than we have ever seen any government do", with LI-3 stating that "there does seem to be a real appetite for change, driven by Covid". However, LI-5 cautioned that although this momentum may "put us back on the path" to appropriate support for active travel, "it remains to be seen if this opportunity will be fully grabbed". LI-8 believes that although the national framework is broadly supportive, as it must cater to different regions, it is set at "not quite the lowest common denominator, but more of an average, which offers a number of constraints to more ambitious areas", although they qualify that London has governance arrangements to bypass this that other regions do not. They also believe a fundamental issue to be that the government and civil service "thinks very much in modal terms, and about modes only in competition", rather than their complementarities, in contrast with the approach taken in many other European countries.

3.2. Autonomy

3.2.1. Capacity (Strong)

London is administered by the Greater London Authority (GLA), which consists of the executive Mayor of London and the 25-member London Assembly, both directly elected by the London public every four years. The Assembly scrutinises the mayor's plans, budgets and decisions, and may amend them by a two-thirds majority. The GLA shares administration with 33 local government districts (32 London boroughs, and the City of London—hereafter the boroughs). According to the GLA Act 1999, the principal purposes of the GLA are to promote economic development and wealth creation, social development, and the environment in Greater London. The mayor also has a duty to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London, and must publish the Mayor's Transport Strategy (MTS) to fulfil this duty. The mayor is required to publish six other strategies, including a London Environment Strategy (LES), which must include policies to mitigate climate change, and a spatial development strategy (the "London Plan"). The Act states that the government may only intervene where strategies are inconsistent with national policy, but the government may issue guidance to the mayor for energy and climate policy specifically. The current guidance "encourages the Mayor to innovate, and, where this is possible and reasonable, go further than national policy" [28].

Transport for London (TfL) is a statutory corporation that exists primarily to implement the MTS, and related duties of the mayor. It is responsible for London's public transport infrastructure and services, including buses, the London Underground, Docklands Light Railway (DLR), London Overground, TfL Rail, London Trams, river services, the Santander Cycles hire scheme, the regulation and licensing of taxis and private hire services, and the Transport for London Road Network (TLRN)—major roads that make up around 5% of London's road network by length, but carry around 30% of its traffic. TfL is governed by a board appointed by the mayor, who may also issue guidance and directions as to how TfL exercises its functions [29,30].

The boroughs are usually led directly by elected councillors, who in turn elect a council leader from among their number. However, four boroughs elect an executive mayor for a four-year term, and who may choose a cabinet of councillors. The borough

councils provide the majority of local services, including managing 95% of London's roads, parking enforcement, and acting as the statutory Local Planning Authority [31]. The GLA Act requires boroughs to publish a "Local Implementation Plan" (LIP) to implement the MTS. The mayor must approve each LIP, and may issue guidance for their production. All English Local Planning Authorities must produce a "Local Plan" for spatial development following national planning priorities. For London boroughs, local plans must also conform to the London Plan.

Local government in England is primarily funded from Council Tax and the Business Rate Retention Scheme (BRRS). Council Tax is levied on residential properties based on their value. Local authorities may increase rates, but if this exceeds 2% annually, a local referendum must be held. In London, the GLA also sets a "precept"; a "top-up" rate on council taxes that boroughs collect for the GLA. The BRRS allows local authorities to retain up to 50% of the increase in local revenue generated from national business rates, levied on the occupation of non-domestic property, in exchange for a reduction in direct government funding (which provides much of the remaining local authority funds). In 2018, London joined a national trial for 100% retention in exchange for the removal of the remaining "GLA Transport Grant" provided by the Department for Transport (DfT) to part-fund TfL. This grant had already decreased substantially, from more than GBP 2.8 billion in 2012 to less than GBP 230 million in 2017 [32]. Its removal meant that TfL became one of the only transport authorities in the world to receive no government support for its day-to-day operations (a position altered in practice since the onset of the pandemic, discussed below).

The GLA Act allows TfL to charge for services (with rates set by the mayor), and allows TfL or boroughs (with mayoral approval) to establish road pricing. Revenue must cover the costs of operation, with profits used to support the MTS. Such powers are additional to usual local authority powers, including the ability to designate parking zones and charge for their use. TfL may acquire, develop, sell or lease land, and to provide funds to third parties for activities that contribute to TfL's objectives. Local authorities in England (both the GLA and boroughs in London) may impose a Community Infrastructure Levy on new developments to fund local infrastructure [33], with certain authorities (including the GLA) able to introduce a Business Rate Supplement (BRS) to fund projects to promote economic development. All English local authorities (including the GLA, but also its functional bodies, such as TfL) may borrow funds within national guidelines [34].

The interviewees agreed that transport is "one area in which [the GLA] does have sufficient autonomy" (LI-5), but there are concerns that since the onset of the pandemic this autonomy is being eroded, as discussed below. LI-8 qualified this view by distinguishing different channels of autonomy. They believe that the GLA "has lots of autonomy to formulate its own vision [and] has a fair amount of decisional autonomy, but at the level of implementation, things get a bit trickier". With ownership and control over the public transport network and the TLRN, and as one of the largest landowners in London [35], TfL can take significant unilateral action and use "trial and error to work out the very best" (LI-1) in low-carbon mobility. However, several interviewees felt the key issue to be a lack of funding, and although the removal of the GLA Transport Grant made TfL "incredibly autonomous, because it had to be" (LI-4), fulfilling all its obligations and ambitions became "a great challenge" (LI-2), as discussed further below, and in Section 3.3. The GLA has relatively limited influence over private transport (LI-4 and 6). Although they must work within the GLA policy framework, boroughs have relatively high autonomy to operate within it. This is further discussed below and in Section 3.5, but the "difference in action between different boroughs is dramatic, and indicates that they do have quite a lot of autonomy from the mayor" (LI-7).

3.2.2. Action (Strong)

The current London Plan, published in March 2016, stated an objective that "over the years to 2036—and beyond, London should [lead] the world in its approach to tackling the urban challenges of the 21st century, particularly that of climate change" [36] (p. 31). The majority of

low-carbon ambitions in this Plan relate to energy efficiency; it requires boroughs to promote walking, cycling and low-emission private transport, but with few specific requirements (such as minimum provision of cycle parking for new developments) [36]. A new London Plan will soon come into force, and which has been developed using the principle of "Good Growth"; growth that is "socially and economically inclusive and environmentally sustainable" [37] (p. 11). The focus and requirements of the new Plan are similar to the current iteration, but with greater stringency [37].

An overarching objective of the current MTS and LES is to "turn London into a zero carbon city by 2050" [38,39]. These strategies lay out plans for decarbonising TfL's infrastructure and operations, including a zero-emission bus fleet by 2037; increasing renewable energy generation on TfL's land; reducing operational emissions from TfL's assets and infrastructure; and for TfL-controlled rail services to be zero-carbon by 2030 by using renewable energy [38,39]. Using its ability to set license conditions, TfL will require all taxis and private hire vehicles (PHVs) to be ZEC by 2033 [38]. Other key targets, plans and policy instruments are discussed in Sections 3.3 and 3.8.

In 2019/20, TfL had a projected budget of GBP 10.3bn—over half the total GLA budget [32]. Around 25% of this was to be met by income from the BRRS and council tax precept, and nearly 50% by fare income. Successive mayors, via TfL, have used their road pricing powers to introduce the London Congestion Charge (LCC) and the Ultra-Low Emission Zone (ULEZ), which alongside commercial activities, were to account for 12% of TfL's budget. The LCC is a GBP 15 daily charge for vehicles entering central London (about 1% of Greater London [40]), between 07:00 and 22:00, except low-emission vehicles. Recent changes to the LCC are discussed below. The ULEZ was introduced in April 2019, covers the same area as the LCC (with an expansion planned in October 2021), operates at all times, and charges GBP 12.50 for private vehicles that do not comply with current EU air pollution (EURO) standards. In 2010, the mayor introduced a BRS on the largest 15% of businesses in London, and a Mayoral Community Infrastructure Levy (MCIL). This income, alongside targeted grants from the GLA, government and boroughs, were projected to cover 15% of TfL's budget in 2019/20. The remainder was due to be sourced from cash reserves and borrowing [41].

The onset of the pandemic and measures to address it, including a nationwide "lockdown" with extensive travel restrictions introduced in March 2020, led to a 90% fall in TfL fare income in the months following. In April 2020, bus and Underground service provision decreased by 13% and 59% respectively, due to operational difficulties and service restrictions. Despite substantially reduced demand, efforts were made to resume usual service provision in order to allow for social distancing on public transport for essential travel. Although bus service provision returned to usual levels by July 2020, Underground service provision remained 7% below 2019 levels until at least October 2020 [16]. The mayor also suspended the LCC and ULEZ. These factors led TfL to project a budget shortfall of GBP 1.9bn between April and October 2020 [42]. In May 2020, the mayor agreed an emergency funding and financing package with the government, worth GBP 1.6bn. However, key conditions included: the immediate reintroduction of the LCC and ULEZ; an increase in fares from January 2021; two government-appointed Special Representatives to attend all TfL Board meetings; and a government-led review of TfL's finances [43]. Despite this, TfL projected an additional shortfall of GBP 2bn by the end of 2020, and GBP 2.9 billion for 2021/22 [42]. In November 2020, a second funding deal worth GBP 1.7 billion was agreed, with further conditions including a requirement for TfL to achieve GBP 160 million in savings, and for travel concessions to be funded separately by the mayor. Initial government proposals to extend the LCC to match the upcoming ULEZ extension, and to further increase fares, were not part of the final terms.

Successive mayors, TfL and the wider GLA appear to have made extensive use of the autonomy afforded; a conclusion supported by all interviewees. The mayor's strategies are wide-ranging and ambitious, as discussed in Section 3.8, and supported by specific actions. TfL is "world renowned" (LI-4) and "a resounding success of devolution" (LI-2). The LCC

and ULEZ are "really good examples of where TfL has put its autonomy to great use, and has shown its potential" (LI-5), although both LI-4 and 6 suggested that road pricing is an area where "autonomy could have been leveraged further than it has been" (LI-4) through a more sophisticated (e.g., time or distance-based) approach. LI-1 stated that although TfL has used its substantial land holdings in some areas, such as installing EV charge points, such action is "a bit piecemeal".

Successive mayors and Assemblies have advanced the case for further devolution. In 2012, the mayor (Boris Johnson) established the London Finance Commission (LFC) to investigate greater fiscal devolution. Their report concluded that "devolving revenue streams, including from the full suite of property taxes, will afford London government the autonomy to invest in the capital and increase its accountability to London's residents and businesses" [44] (p. 10). They argue that just 7% of all taxes paid by London residents and businesses is retained by London authorities, whereas in New York, for example, this value is 50%. [44]. The Commission was reconvened in 2016 by Sadiq Khan, and published a new report that proposed allocating to the GLA a proportion of income tax and VAT revenue that would normally accrue to the government [45]. LI-1 also believed further devolution would be of benefit, and stated that if given "the right capability, there is loads more [TfL] could do".

The COVID-19 pandemic has "highlighted how fragile the funding for [TfL] is, because it's so reliant on passenger fares which have been demolished" (LI-5). However, LI-4 believes that the conditions of the emergency financing packages have "created space for the government to leverage slightly more influence over what is ordinarily quite an autonomous transport authority", with LI-1 "very worried that a lot of that independence is going to be lost", with government attempting to "'claw back some autonomy" (LI-6). LI-1 and 8 feel that this in part a political fight between the mayor and government, with the government now having "parked its tanks on the lawn of the mayor" (LI-7). At the borough level, LI-1 felt that although some use their autonomy well, "the majority don't, not remotely", and most "don't do a terribly good job of making use of adopted roads and adopted highways, particularly in restricting use to active travel" (LI-4). LI-5 believed that most boroughs could make more use of their spatial planning powers, and be more assertive with developers to include low-carbon mobility infrastructure. The interviewees broadly agreed that those more likely to put their autonomy to use are the more central boroughs (for reasons discussed in Section 3.9). Elements of borough autonomy are further discussed under Sections 3.3 and 3.5, in particular.

3.3. Access to Funding for Climate Action

3.3.1. Capacity (Moderately Strong)

The ability and discretion GLA (and TfL) have to raise and spend funds are described in Section 3.2. A recent report by the London Sustainable Development Commission (LSDC, discussed in Section 3.5), however, concluded that "the direct spending power of the Mayor is several orders of magnitude less than that necessary to achieve a zero-carbon economy for the capital" [46] (p. 11). In addition, around 87% of TfL's income is required simply to maintain and operate the existing network [47]. Much of the transport-related funding for boroughs is provided by TfL, to implement LIPs. For 2020/21, TfL allocated GBP 200 million for this purpose, of which boroughs have full discretion over less than 2% [48]. LIP funding was paused in 2020 as TfL worked "to meet the conditions in our funding and financing recovery package" [49], but resumed in November 2020. One such condition was the establishment of a GBP 55 million Active Travel Plan for London, including GBP 45 million for boroughs to invest in related infrastructure (with the remaining GBP 10 million for TfL). In May 2020, the government announced a national Active Travel Fund of GBP 250 million, of which London (TfL and the boroughs) was allocated a further GBP 25 million. Other government funds, those described previously, have been available, although London authorities are often ineligible due to their specific devolution and funding arrangements (see Section 3.2). In the LES, the mayor calls on

government to ensure "that London can access national funding on the same basis as other local authorities" [38] (p. 101). However, the government does provide funding for specific, usually large infrastructure projects. A key example is Crossrail (The Elizabeth Line), the largest railway infrastructure project in Europe, for which the government is providing around half the projected GBP 17.6bn cost [50].

LI-7 felt that it was "very clear that the removal of the [GLA Transport] Grant was pretty brutal for TfL" (LI-7), and limited its ability to fund climate action. Although there is a lot of ambition to drive low-carbon mobility (see Section 3.8), "it is difficult to see where the money is going to come from" (LI-2), and TfL are "hampered by inability to invest and plan for the long-term [without] a stable footing to deliver its policy priorities" (LI-2). Interviewees agreed that this situation has worsened with the pandemic, as income for the GLA, TfL and boroughs has "fallen off a cliff" (LI-4). LI-4 believes that "the funding climate is incredibly challenging; a number of boroughs have been running on a very shoestring budget for a number of years".

3.3.2. Action (Strong)

The GLA and TfL make broad use of their ability to raise funds, as discussed in Section 3.2. In addition, in 2015, TfL issued a ten-year green bond, raising GBP 400 million to be invested in public and active travel [46,51]. In January 2020, another issuance was announced, with proceeds allocated to clean transport, pollution control and renewable energy [52]. TfL have also committed to leverage other sources of finance where possible, such as selling surplus land to develop affordable housing, with proceeds allocated to TfL's transport investment programme [39]. In 2018, TfL Consulting was launched to commercialise TfL expertise by partnering with cities and regions around the world. By 2023, it aims to have generated GBP 45 million in revenue [53]. A "fare freeze" introduced by the current mayor in 2016 is estimated to have reduced TfL income by around GBP 640 million by 2020, with concessions costing a further GBP 300 million [47,54]. Alongside ending the fare freeze and reducing concessions, a report by the London Assembly recommended that additional revenue be generated through TfL's advertising capabilities, sponsorship, TfL consulting, constructing and renting properties on its estate, and making efficiency savings. A recent LSBC report recommended the establishment of a London Future Finance Facility, offering a channel for clean investment. Both the London Assembly and LSDC also recommended further devolution of fiscal powers [46,47].

The vast majority of TfL's expenditure may be considered as spending on climate action, as without it, CO_2 emissions from passenger mobility would be higher. The lack of data makes assessing spending with this explicit purpose difficult. However, the mayor has committed around GBP 1.8bn for "Healthy Streets" (see Section 3.3) between 2019 and 2024 [55], most of which is for public and active travel infrastructure. TfL also operate a car and motorcycle scrappage scheme for London residents that receive welfare benefits, to replace vehicles that don't comply with ULEZ requirements [56]. Of the GBP 200 million provided to boroughs for LIP implementation, around GBP 170 million is to be spent on Healthy Streets, including over GBP 60 million for cycling infrastructure [48]. Over time, "TfL has become more and more stringent about how it applies its funding [for boroughs], and has added more and more strings" (LI-7). A range of other grants for boroughs are occasionally available from TfL, such as the Mayor's Air Quality Fund—GBP 22 million to support projects by boroughs to improve air quality, but which is currently closed to new applications [57].

The GLA and TfL have been reasonably successful at receiving government funds to which they can apply. For example, TfL received around 15% of the budget from the ULEB Scheme [58]. In 2016, a collaborative bid between TfL, GLA and London Councils (described in Section 3.5) was awarded GBP 13 million as part of the national GBP 40 million Go Ultra Low Cities Scheme between 2016 and 2020 [59]. The boroughs also receive ad hoc DfT grants, such as GBP 2 million each to provide cycle training in August 2020 [57]. In addition, through the London European Partnership for Transport (LEPT)

operated by London Councils, LI-5 believed that "boroughs had been quite good at getting EU funding, particularly for transport projects", but are now largely ineligible. The interviewees believed that action taken by boroughs to raise funds for climate action varies substantially, largely due to differences in "public views on [low-carbon] modes of transport, and the access they have to TfL's network" (LI-4). Interviewees agreed that inner boroughs, with strong transport connections and which tend to be led by councils of the same political persuasion as the current mayor, are more active, while many of the outer boroughs are "dragging their feet to avoid doing what the mayor wants for as long as possible" (LI-7). However, LI-4 felt that some of the difference "comes down to the different capacities that boroughs have to apply for these pots of money", and that some boroughs have invested in developing strong, highly engaged transport teams over a number of years, allowing them to identify and apply for available funds effectively.

3.4. Vertical Coordination

3.4.1. Capacity (Weak)

The Department for Business, Energy and Industrial Strategy (BEIS) is responsible for developing government strategy to achieve the goals of the UK's Climate Change Act. However, Sasse, Rutter, Shepheard and Norris (2020) find that climate action is not a top priority in BEIS; only one of BEIS' five main objectives relates to this issue ("ensure the UK has a reliable, low cost and clean energy system") [60]. The DfT sets policy and regulation for all modes of transport, including active travel. The Ministry of Housing, Communities and Local Government (MHCLG) is responsible for spatial planning, while the Treasury (the UK's Ministry of Finance) is responsible for tax policy and broad allocations of government budgets. Although the term 'sustainability' is used, none of the key objectives of these departments explicitly reference decarbonisation or its synonyms [61–63]. Despite its coordination role, BEIS holds few levers to compel action by other departments, and there are few cross-departmental processes or bodies dedicated to decarbonisation; a key exception is the Office for Low Emission Vehicles (OLEV), operated jointly by BEIS and DfT, to support the market for ultra-low emission vehicles (ULEVs) [64]. The Climate Change Committee (previously Committee on Climate Change) was created to advise the UK and devolved governments climate action, but as an independent advisory body, it has no decision-making authority. Beyond the parameters of GLA autonomy laid down by the GLA Act described in Section 3.2, there are no formal processes for vertical coordination. Both the GLA and TfL maintain Government Relations teams that, inter alia, produce briefings, engage with parliamentarians and government officials to promote the mayor's priorities, and manage GLA responses to government consultations [65]. The GLA can also publicly state its position and call on government to act in areas of concern, such as through the mayor's strategies.

3.4.2. Action (Moderately Weak)

As described in Section 3.2, government has issued guidance for the preparation of energy and climate element of the LES. There is no evidence to suggest that the government has required alterations the MTS or LES, but the government directed the mayor to alter the upcoming London Plan (including to relax measures to reduce car ownership and use) [66]. Beyond this, coordination is largely conducted on a case-by-case basis, focusing on large capital investments (e.g., Crossrail). In May 2020, the government announced it would begin trials of rental e-scooters in England. In November 2020, TfL and London Councils jointly announced that they will host a twelve-month trial. The interviewees held a common view that prior to the pandemic, coordination between government and TfL was "not good enough . . . really challenging" (LI-1), as although DfT seeks to encourage low-carbon mobility, "it also has a number of other [objectives]" that can make coordination difficult (LI-4). In addition, government thinking was often "well, just give it to TfL and the GLA and that's dealt with" (LI-5). However, LI-3 and LI-6 believed that coordination improved during the pandemic, with four interviewees citing e-scooter trial discussions as

a positive example, although there have been "heated discussions between DfT and TfL on the nature" of these trials (LI-4).

3.5. Horizontal Coordination

3.5.1. Capacity (Strong)

The GLA Act allows the mayor to make up to 11 appointments, to whom powers and responsibilities may be delegated (with some exceptions, such as the power to direct TfL), At present, there is a Deputy Mayor for Environment and Energy and a Deputy Mayor for Transport. The mayor has also appointed a Walking and Cycling Commissioner, reporting to the Deputy Mayor for Transport. The GLA is also able to constitute advisory bodies, such as the LSDC, established in 2002 to provide independent advice on delivering the GLA's duties on sustainable development [67]. As discussed in Section 3.2, TfL's primary responsibility is to implement the MTS, and it has direct control over London's public transport network, the TLRN, and other non-borough transport functions. The current mayor has appointed himself Chair of TfL, and the Deputy Mayor for Transport as Vice-Chair.

In preparing their strategies, the mayor must consult with the Assembly, GLA's functional bodies (including TfL), and each borough. Although there is no obligation for the views of these bodies to lead to amendments, the mayor must outline which have and have not been accepted, and why. In turn, each borough must conform to the final strategies. For spatial planning, the National Planning Policy Framework (NPPF) states that "local planning authorities are under a duty to cooperate on strategic matters that cross administrative boundaries" [68] (p. 10). The MTS, LES and the London Plan all pledge the mayor to work with the boroughs to deliver their aims [37–39]. In 2018, TfL established a Local Communities and Partnerships Team to provide a single point of contact for boroughs, and to understand how TfL can "better support [boroughs] to ensure [TfL's] strategies are clear and relevant, and take into consideration [borough] needs" [69] (p. 6). TfL has also published a range of guidance and toolkits to help boroughs engage with TfL's campaigns and schemes. The GLA Government Relations Team (discussed in Section 3.4) also works with the boroughs, including "through the Congress of Leaders, where the Mayor discusses key London issues with borough leaders" [65].

The main platform for inter-borough coordination and cooperation is London Councils, a cross-party organisation that "makes the case to government, the mayor and others to get the best deal for Londoners and to ensure that our member authorities have the resources, freedoms and powers to do the best possible job for their residents and local businesse" and seeks to act "as a catalyst for effective sharing among boroughs" [70]. It has a dedicated Transport and Environment Committee with members representing each borough and TfL, and operates the London Environment Directors' Network (LEDNet).

3.5.2. Action (Moderately Strong)

Although "London is in a very unique [sic] position, as the mayor is also the leader of the transport authority" (LI-4), LI-3 thought that the political nature of the GLA sometimes produces "political winds that can bash TfL about", creating tension, which has exacerbated during the pandemic. LI-3 also believed that TfL can often see itself as a sister rather than daughter organisation to the GLA, producing further conflict. Together, they believed that this could sometimes lead to a lack of communication and transparency, but overall the "dynamic between GLA and TfL can be both good and bad". A study commissioned by TfL found that although 83% of borough representatives surveyed believed TfL could be trusted, and 78% believed that they communicate openly and honestly, just 51% knew how to effective engage with TfL. Respondents also believed that TfL was too bureaucratic, and that it does not take sufficient notice of borough priorities [69].

LI-5 believes coordination between TfL and the boroughs to be "generally fairly good", although LI-2, 6 and 8 thought it to be a very mixed picture, with LI-3 believing it "haphazard at best". Broadly, although LI-1 feels that coordination is "mostly effective –

the city works, it functions very well", they also feel that the "GLA has no powers over the [boroughs], really at the end of the day, the boroughs will do what they want". LI-6 believes that in order to achieve his goals, the mayor may eventually be forced to compel some boroughs to act, or to take direct control of their LIPs. However, "these tactics are tough and questionable—and not nice options" to have to use (LI-7). So far, interviewees believed that the mayor and TfL have been "unwilling to wield the stick", instead taking "a carrot led approach" (LI-1), in part to avoid raising tensions, as "boroughs don't like that TfL can say yes or no to who gets money for what" (LI-1), yet "TfL cannot deliver without some form of cooperation" (LI-7), as "mobility governance is still quite fragmented, [with the] distribution of responsibilities quite complex" (LI-8). LI-3 believed that where coordination is effective, it is often because "two officers [in TfL and a borough] who know each other have joined the dots". LI-5 stated that some boroughs "are easier in their dealings with TfL than others", in part due to differences in politics and priorities, but also "how well equipped the borough is to deal with transport schemes; if they have good plans, are good at spending the money and meet all the deadlines, then they will have a good relationship with TfL. Those that don't, won't". Similarly, on inter-borough co-operation, LI-4 believed "quite different political objectives make a joined-up approach quite hard to achieve", which is "something than could be improved on a lot" (LI-5). Often, "the relationships aren't the best" (LI-5), leading to issues such as "cycle lines [that] just stop at borough boundaries" (LI-5). LI-2 believed boroughs are not necessarily "making bad decisions, but different decisions", which "gums up the roll-out" (LI-2) of car clubs, dockless bikes and cycle infrastructure, for example.

3.6. Membership of Capacity-Building and Learning Networks

3.6.1. Capacity (Moderately Strong)

London is a member of C40 Cities, a network of 97 megacities that "supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change" [71]; the Global Covenant of Mayors for Climate and Energy, "the largest global alliance for city climate leadership, built upon the commitment of over 10,000 cities and local governments" [72]; and the Carbon Neutral Cities Alliance, a "collaboration of leading global cities achieving carbon neutrality before 2050" [73]. In Europe, aside from the European iteration of the Global Covenant of Mayors, London is largely represented by individual boroughs. This includes, for example, CIVITAS, a "network of cities dedicated to cleaner, better transport in Europe and beyond" [74], to which the boroughs of Bromley, Hammersmith and Fulham, Sutton, and the City of London belong, and POLIS, "the leading network of European cities and regions working together to develop innovative technologies and policies for local transport" [75], to which all boroughs are members via the LEPT. In the UK, 15 boroughs belong to UK100, "a network of highly ambitious local government leaders, who have pledged to secure the future for their communities by shifting to 100% clean energy by 2050" [76], and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT), to which the City of London is a direct member, as well as all other boroughs through the LEDNet, with TfL being an associate member.

3.6.2. Action (Strong)

One of the five key principles of the LES is to collaborate "with leading climate change and environmental institutions and other world cities, sharing ideas and learning from best practice" [38] (p. 22), particularly through the C40, which was founded in 2006 in London following a meeting convened by Mayor of London Ken Livingston [77]. London sits on the steering committee, and the Deputy Mayor for Environment and Energy is a board member. London is also a lead signatory to the C40 Fossil-Fuel-Free Streets declaration (which pledges each city to procure only zero-emission buses from 2025, and ensure that a major area of each city is zero emission by 2030) [78], and participates in the C40 Climate Action Planning Framework, which was used to support the development

of London's "1.5 °C Compatible Plan" (discussed in Section 3.8) [79]. London is active in other networks, with GLA officials sitting on two of the three managing committees of the Covenant of Mayors [80]. The mayor and the GLA have "been really active" (LI-5) in the C40 in particular, but largely to showcase action in London, as the city is "very proud of its achievements . . . the creation of TfL and the congestion charge were genuinely admired and admirable" (LI-8). LI-5 believed that London Councils supports many networks, but active participation by boroughs has declined due to funding cuts. However, LI-1 stated that although "sharing leads to doing, often I feel it is just sharing", with LI-2 feeling that there is a "worthwhile entity overload", and often a "lack of joined up thinking among such organisations partly just because of the scale of the problem [of climate change]" (LI-3). LI-4 believed that the sheer size and complex governance structure in London makes learning lessons from other cities difficult.

3.7. Collaboration with and Participation of Stakeholders

3.7.1. Capacity (Strong)

In exercising their statutory authority, in addition to public bodies described in Section 3.5, the mayor must consider consulting bodies representing different racial, ethnic, national and religious groups, and businesses. For the MTS specifically, they must also consult the national Disabled Persons Transport Advisory Committee. Government guidance on preparation of the energy and climate element of the LES encourages the mayor to consult with a range of specific organisations, although none have a focus on transport [28]. Shortly after entering office, the current mayor published "A City for All Londoners", which set out priorities to be fully developed through his strategies, and on which stakeholder views were gathered through workshops, focus groups and discussions via "Talk London" [81], an online platform "where you can have your say on London's big issues" [82]. Drafts of the current LES, MTS and upcoming London Plan were subject to a 14-week public consultation, advertised through the GLA website. For the LES, views were sought through online discussion threads and surveys on Talk London, email campaigns, online forms, focus groups, interviews, representative polling and events. For the MTS consultation, operated by TfL and advertised through the TfL "Consultations Hub", "an extensive marketing and engagement programme to seek the views of Londoners, businesses and stakeholders" [83] took place. TfL also seek views on new guidance, policy, and major projects [84]. The mayor's guidance for LIP preparation states that boroughs "may wish to consult with" (inter alia) elected members and the borough's Director of Public Health, local community, business and transport groups [85] (p. 12).

The MTS, LES, London Plan and 1.5 °C Compatible Plan (discussed in Section 3.8) all repeatedly state that the mayor, the GLA and TfL will work with stakeholders to achieve their objectives. TfL maintain an "innovator database" to which organisations may register to receive information on TfL innovation programmes. TfL have also "committed to making our open data freely available to third parties and to engaging developers to deliver new products, apps and services for our customers", believing that this "facilitates the development of technology enterprises [through] effectively crowdsourcing innovation" [86].

3.7.2. Action (Strong)

When consulting on the LES, the GLA received, inter alia, 5400 survey responses on Talk London, and 370 responses via an online webform [87]. TfL received 43,550 individual comments [83] for the MTS consultation. In both cases, responses were reported and amendments recommended in a publicly available report to the mayor. All recommendations for the MTS were implemented. For all other consultations, TfL publish responses to feedback on their website [84]. Consultation responses to the London Plan were made available online, with an updated plan published following a review of responses [88]. When preparing their LIPs, the mayor requires boroughs to demonstrate that stakeholder views have been considered [85].

Although TfL "went through a time when it had a very patrician approach" to stakeholder engagement (LI-7), it has "generally got a lot better in recent years" (LI-5). LI-3 felt that "TfL does a really phenomenal job [on consultation], at least when it comes to new projects [and] in terms of sincerity, I think it really stands out—pretty much second to none" and responses are often reviewed item-by-item. The "GLA and TfL tries its best to include everyone" (LI-1), and there is "a lot of will to involve different parties" (LI-8), but it is "quite difficult to engage everyone" (LI-8). Although TfL are getting better at seeking "silent" views, this is not seen as a priority (LI-6). Although policy officers at TfL usually weight stakeholder responses based on representativeness (LI-6), the level of attention granted to different groups tends to "wax and wane" over time (LI-2). Taxi drivers were identified as a group that "shout very loud" (LI-6), and used to have a substantial level of influence, but less so now (LI-2 and 7). In general, "boroughs are quite good at listening to different views" (LI-5), but "the management of stakeholder relationships is completely variable" (LI-7). LI-5 felt that the voices listened to largely depend on local politics, as councillors "have to take a political decision on what they're going to risk". Various interviewees raised the emergency measures introduced following pandemic restrictions, many of which were introduced without consultation, and which some boroughs have found difficult as they "are used to talking to their residents before they implement schemes" (LI-5). However, LI-5 believed that both boroughs and TfL have been responsive to concerns, with engagement "happening as part of a live scheme" (LI-7).

TfL has established "Innovation Partnerships" with companies to develop new products and services. This includes the "London Connectory"; a partnership with Bosch to allow small businesses to work with experts and TfL data to develop new transport-related products [89]. TfL have published "problem statements" to source new mobility solutions, and a call to participate in a new "Innovation Collaboration Framework", to allow TfL rapid access to corporate R&D facilities [89]. Around 42% of Londoners use an app with TfL data, across more than 600 apps developed by around 13,000 developers, generating GBP 130 million in economic benefits and savings a year [90]. LI-6 stated that the GLA and TfL are frequently approached by technology companies looking for collaboration, although TfL believe in "being able to fix problems with incumbents and transnational corporations" (LI-8).

3.8. Presence of Local Climate Champion

3.8.1. Capacity (Strong)

As described in previous sections, the mayor holds broad executive power over (particularly public) transport in London, through direct and indirect channels. The London Assembly provides some check and balance through its powers described in Section 3.2, and its ability to investigate any mayoral action, and to submit proposals to the mayor to which a response must be provided. The Assembly must also confirm certain mayoral appointments, including the Chair and Deputy Chair of TfL. The mayor must submit an activity report to the Assembly ten times a year, on which they are questioned. Members of the public directly question the mayor and the Assembly twice a year, and the mayor must also participate in an annual "State of London" debate and publish an annual report on developments and achievements. Although there are few formal curbs on mayoral action on transport within the GLA and TfL's remit (either from the Assembly or government), there is extensive scrutiny. The Mayor of London is one of the most high-profile political positions in the country, with 93% of the British population having heard of the incumbent (the third mayor), Sadiq Khan [91]; with his immediate predecessor, Boris Johnson, now Prime Minister.

3.8.2. Action (Strong)

The mayor aims to achieve zero CO_2 emissions in London by 2050, and has adopted London-wide carbon budgets, following the approach taken by national government [38]. The mayor has set targets of, by 2041, having 80% of all trips in London made by public or

active transport, increasing rail service capacity by at least 80%, and reducing road traffic by 10–15% [39]. The MTS, LES and upcoming London Plan include a core principle of "Healthy Streets", which "provides the framework for putting human health and experience at the very heart of planning the city", to ensure that "individual streets are appealing places to walk, cycle and spend time" [39] (p. 5). Key actions regarding TfL's infrastructure and operations in particular are discussed in previous sections. The strategies contain various other actions to encourage active travel, including delivering a London-wide strategic cycle network with improved infrastructure; encouraging restrictions on vehicle movements; protecting and improving walking routes; imposing expectations on developers to promote active modes; and using data to allow journey planning tools to favour walking and cycling [37–39]. For private transport the mayor aims to have all newly registered vehicles in London zero-emission by 2030, through inter alia, investigating proposals for more sophisticated road user charging systems to replace the LCC and ULEZ; introducing a zero emission zones in central London from 2025, increasing to London-wide by 2050 at the latest; supporting car clubs and reducing private parking; ensuring sufficient charging and refuelling infrastructure for ULEVs, and introducing other regulations and incentives to support their use [37–39].

To support his ambitions, the mayor has suggested further competences to be devolved in addition to those discussed previously, including powers to implement time-limited road closures, greater control of PHV licensing (including the ability to cap numbers), allowing the London Plan to take precedence over national planning policy, and responsibility for suburban rail services [39]. The mayor supports further action at the national level (without which he acknowledges his overarching decarbonisation goal cannot be met), for which his strategies may act as "the template for ambitious action" [38] (p. 6).

An Implementation Plan was published alongside the LES, against which annual progress is reported. The London Energy and Greenhouse Gas Inventory (LEGGI) reports GHG emissions and energy consumption from homes, workplaces and transport in London, and is used to measure progress against emission targets [14]. In December 2018, the London Assembly passed a motion calling on the mayor to "declare a Climate Emergency, supported by specific emergency plans to make London carbon neutral by 2030, [and] call on government to give him the powers and funding to make this possible" [92]. A few days later, the mayor published "Zero Carbon London: A 1.5 °C Compatible Plan", in which he states that "the world is now clearly in the midst of a climate emergency" [93] (p. 6), and outlines the expected impacts of his strategies on CO_2 emissions to 2050, and associated costs. The mayor has announced that if re-elected in 2021, he will aim to make London carbon-neutral by 2030 [94].

The interviewees believed that "Sadiq Khan has made very loud and bold statements on climate" (LI-7), that he "has some pretty ambitious policy targets" (LI-4), and is "definitely providing leadership" (LI-5). While LI-6 believed that the introduction of the ULEZ was a good example, others would "like to have seen a lot more" (LI-1) and felt that if is "not a political winner, the mayor tends not to really push TfL" (LI-3). To date, 26 of 32 boroughs have declared a "climate emergency", with many aiming for net-zero emissions from their own operations by 2030 [95]. Although "some boroughs are showing quite a lot of leadership" (LI-5), others "don't seem willing to engage on the climate crisis" (LI-7), with climate emergency declarations "very quickly falling to the sidelines" (LI-4), often due to lack of funding, although some simply "aren't [keen to push] the mayor's agenda" (LI-3).

3.9. Conducive Urban Form and Infrastructure (Moderately Strong)

With a population density of 5700/km^2, London is by far the most densely-populated English region [96], and more dense than comparable regions for Paris, New York and Berlin, but less dense than Hong Kong, Singapore and Tokyo [97]. London is considered polycentric; in assessing journeys on the underground network, Roth, Kang, Batty and Barthélemy found three "core" centres of activity, and a further seven secondary centres

in central London [98]. However, other centres may emerge if this analysis is extended to include other modes. LI-7 felt that "London is, amazingly for its size, incredibly well configured" for the transition; by contrast, LI-3 believed that "of major [world] cities, [London is] one of the most ill-suited to this transition that I've come across". LI-4 and 7 both believed that London's size "presents some challenges" (LI-7), and as London "is one of the oldest cities in the world with pipes and tunnels everywhere", reconfiguration is "very hard and very expensive" (LI-1). LI-2 believed that the underground network forms the "spine of low-carbon mobility in London". Although LI-4 agreed that the Underground and wider public transport system is "incredibly comprehensive, incredibly vast", it is also "incredibly centralised", in that it is designed to move as many people into the centre as efficiently as possible. Despite the conclusions of Roth et al. [98], there is a common view that "London is a very unicentric city [with] everybody commuting into the centre" (LI-3), and that "parts of outer London are very underserved by public transport" (LI-4), which alongside issues such as fewer pavements (LI-6), means that such areas are "much more car dominated and car dependent, even more so than many people believe" (LI-8). Although expanding the Underground would be difficult in a "very complicated subterranean world", improving bus connectivity has substantial funding implications (LI-2). LI-3 felt the pandemic may facilitate "real shifts in behaviour", particularly with home working, leading to London re-emerging as a "collection of villages", (LI-7), with more investment in areas that people both live and work (LI-1), potentially entrenching new mobility habits (LI-4).

3.10. Societal Pressure (Moderately Strong)

In June 2020, 81% of UK adults were concerned about climate change, with just 3% unconcerned [99]. Prior to the pandemic, the environment was perceived as the third most important issue facing the country, after Brexit and healthcare (and above the economy) [100], with around half the population (higher in urban conurbations such as London) concerned about air pollution from road transport [101]. Following nationwide 'lockdown' restrictions introduced in March 2020, concern over COVID-19 was greater than for climate change, but a majority believed that government should prioritise reviving the economy and tackling climate change equally once the pandemic recedes [102]. In July 2020, a third of the English population felt the pandemic had made them more concerned about climate change and air pollution (with 8% less concerned) [103]. However, over 80% of the English adult population are wary of using public transport since the pandemic began, with less than a quarter having concerns over the use of private cars, or walking and cycling. Around 40% of people are walking and cycling more compared to pre-pandemic, with almost all planning to maintain this into the long term [101,103]. In London specifically, 39% of people believe that they would use public transport less once restrictions are lifted [104], with around 90% of people concerned about using the Underground [103]. Londoners strongly approve of the mayor's transport policies, with a majority supporting measures introduced during the pandemic [105]. Polls also suggest that the mayor is substantially more popular than his nearest rival for the next mayoral term [106].

Societal pressure for climate action in London "has certainly gone up" over time (LI-8), although there is "never as much as you'd hope" (LI-1), and "the difference is stark between inner and outer boroughs" (LI-3), with the former typically much more in favour of action. However, LI-8 felt that low-carbon mobility, and particularly cycling, had become embroiled in a broader "culture war", linked to gentrification and issues of mobility justice. LI-1 and 4 believe that commercial interests tend to be against measures to change transport behaviour, although LI-5 noted that once such measures have been introduced, opposition tends to diminish. LI-6 believed that due to the pandemic "fear [of public transport] may now stick in people's minds", and if this does not change, it "will have huge implications" (LI-8).

4. Conclusions

Table 3 summarises the scores awarded to each enabling factor and lens. London's city authorities have a strong capacity for autonomy and stakeholder participation, and for an effective local climate champion to emerge. In each of these cases, it takes clear advantage of these capacities to encourage low-carbon passenger mobility. City authorities can and do raise substantial funds for low-carbon mobility, although discretionary spending is limited by obligations to maintain London's extensive public transport network, and the lack of external financial support. This has been exacerbated since the onset of the COVID-19 pandemic, as public transport fare income fell drastically. Emergency finance deals with the government may have long-term implications for London's autonomy over passenger mobility, which run counter to local demands for greater devolution. The UK's legal and political environment is largely supportive of urban climate action, particularly through its net-zero emissions target, but the policy framework focuses on reducing CO_2 emissions from passenger vehicles, with lacunae in public and active transport. There are also few processes for vertical co-ordination between national and local decision-makers.

Table 3. Summary of assessment scores.

Enabling Factor	Capacity				Action			
	W	MW	MS	S	W	MW	MS	S
Supportive political and legal context								
Autonomy								
Access to funding for climate action								
Vertical co-ordination								
Horizontal co-ordination								
Membership of capacity-building and learning networks								
Collaboration with and participation of stakeholders								
Presence of local climate champion								
Conducive urban form and infrastructure								
Societal pressure								

Note: ('W' = Weak; 'MW' = Moderately weak; 'MS' = Moderately strong; 'S' = Strong; grey shading = not applicable).

Despite two administrative levels with complex and interdependent roles and responsibilities, there are robust and varied processes for coordinated climate action on passenger mobility in London, owing primarily to the presence of a single public transport operator under direct influence of the mayor. These processes generally work well, although the mayoralty has been politically reluctant to use its most forceful levers to drive action by recalcitrant boroughs. Public and political attitudes differ between inner- and outer-London boroughs, with the former typically more disposed towards climate action and low-carbon mobility. This may be substantially linked to urban form; although London's public transport network is vast and multi-modal, its infrastructure is concentrated in the centre, with peripheral boroughs more car-dominated.

Although CO_2 emissions from passenger mobility in London are declining, much more rapid progress is required to achieve net-zero emissions; particularly if this aim is brought forward from 2050 to 2030. The analysis presented by this paper does not seek to assess whether the measures taken by London's city administration are sufficient or appropriate to achieve these aims, but whether the governance arrangements are sufficient to facilitate them. On this basis, although a broadly positive assessment is made across most enabling factors, two key areas of deficiency remain. First, the UK government must provide a more supportive policy framework at the national level for rapid decarbonisation in this sector, with much improved co-ordination and funding for local authorities—including the GLA and London boroughs—that must take much of the granular action to achieve it. Secondly, action must be taken to improve horizontal co-ordination within London, to accelerate efforts by boroughs to implement and achieve the mayor's policies and targets. This is particularly the case with outer boroughs, which remain car-dominated. However, such

action exceeds issues of process and policy, and more firmly enters the realm of politics, strongly influenced by the preferences of the local populace and the form of the urban environment they inherited.

The COVID-19 pandemic may transpire to be a transformative event, addressing both of these deficiencies to some degree. The pandemic has drastically reduced public transport use in London, in favour of both private cars and active travel, with large numbers of people now working from home. The extent to which these trends can be altered or embraced to drive low-carbon mobility in London in the long-term is an open question, and one which requires governance structures and processes to be at their most facilitative to address effectively.

The framework applied by this paper provides a flexible approach to generating a snapshot of the strengths and weaknesses of governance arrangements for climate action. However, it relies to a substantial degree on subjective judgement, and does not assess whether these arrangements have produced effective action. Future work to expand this framework to incorporate analytical frameworks on the characteristics of policy mixes (e.g., [107,108] would allow a more rounded view of the policy environment for climate action at the city level). Adapting the framework to apply to other areas of environmental concern, particularly local air pollution, would also likely prove useful.

Funding: Research for this paper received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 730403.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the UCL Bartlett School of Environment, Energy and Resources (approved 16 July 2020). Data protection reference number. Z6364106/2020/07/108.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the protection of data provided by annonymised interviewees.

Acknowledgments: The author wishes to thank Benjamin Sovacool (SPRU) for his input and advice.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Semi-Structured Interview Questions

1. Do you believe that there is a supportive political and legal context (i.e., in higher levels of governance) for the transition to low-carbon mobility in London?
2. To what degree do you believe London has sufficient autonomy to introduce appropriate policy strategy, mechanisms and instruments to drive the transition to low-carbon mobility in London? Do you believe that city authorities make use of the autonomy that is afforded?
3. To what degree do you believe that London has access to funding for action to develop low-carbon mobility (from any source)? To what degree do you think the city authorities use the funding they may raise or receive for this purpose?
4. To what degree do you feel that there is effective co-ordination between low-carbon mobility policy action at the city level, and higher levels of governance (e.g., national and EU)?
5. To what degree do you feel there is effective co-ordination on low-carbon mobility policy between different city-level bodies, and London boroughs?
6. To what degree do you feel that London participates in capacity-building and learning networks and processes, with regard to low-carbon mobility in particular?

7. To what degree do you feel that city authorities engage or collaborate with stakeholders in developing and implementing policy and initiatives relevant to low-carbon mobility in London? Do you feel that engagement with a wide range of stakeholder groups is sought, and to what degree do you feel such engagement influences the design and operation of policy and initiatives?
8. To what degree do you feel city-level leaders are providing support and leadership for the development of low-carbon mobility in London?
9. To what degree do you believe that the urban form and pre-existing infrastructure in London is suited to the transition to low-carbon mobility in London?
10. To what degree do you believe that there is societal pressure for London to drive the transition to low-carbon mobility in the city?
11. To what degree to you believe that the above factors have changed, or are likely to change, in the near to medium-term, as a result of actions to tackle the direct or indirect effects of COVID-19?

References

1. Climate Action Tracker The CAT Thermometer. Available online: https://climateactiontracker.org/global/cat-thermometer/ (accessed on 19 January 2021).
2. van der Heijden, J. Studying urban climate governance: Where to begin, what to look for, and how to make a meaningful contribution to scholarship and practice. *Earth Syst. Gov.* **2019**, *1*, 100005. [CrossRef]
3. Grazi, F.; van den Bergh, J.C.J.M.; van Ommeren, J.N. An empirical analysis of urban form, transport, and global warming. *Energy J.* **2008**, 97–122. [CrossRef]
4. Makido, Y.; Dhakal, S.; Yamagata, Y. Relationship between urban form and CO 2 emissions: Evidence from fifty Japanese cities. *Urban Clim.* **2012**, *2*, 55–67. [CrossRef]
5. Fang, C.; Wang, S.; Li, G. Changing urban forms and carbon dioxide emissions in China: A case study of 30 provincial capital cities. *Appl. Energy* **2015**, *158*, 519–531. [CrossRef]
6. Haarstad, H. Where are urban energy transitions governed? Conceptualizing the complex governance arrangements for low-carbon mobility in Europe. *Cities* **2016**, *54*, 4–10. [CrossRef]
7. van der Heijden, J.; Luckmann, O.; Cherkasheva, A. Urban climate governance in Russia: Insights from Moscow and St. Petersburg. *J. Urban Aff.* **2020**, *42*, 1047–1062. [CrossRef]
8. Nguyen, T.M.P.; Davidson, K.; Gleeson, B. Metropolitan Strategies and Climate Governance: Towards New Evaluative Approaches. *Int. J. Urban Reg. Res.* **2018**, *42*, 934–951. [CrossRef]
9. Koop, S.H.A.; Koetsier, L.; Doornhof, A.; Reinstra, O.; Van Leeuwen, C.J.; Brouwer, S.; Dieperink, C.; Driessen, P.P.J. Assessing the Governance Capacity of Cities to Address Challenges of Water, Waste, and Climate Change. *Water Resour. Manag.* **2017**, *31*, 3427–3443. [CrossRef]
10. Tanner, T.; Mitchell, T.; Polack, E.; Guenther, B. Urban Governance for Adaptation: Assessing Climate Change Resilience in Ten Asian Cities. *IDS Work. Pap.* **2009**, *2009*, 01–47. [CrossRef]
11. Sovacool, B.K.; Van de Graaf, T. Building or stumbling blocks? Assessing the performance of polycentric energy and climate governance networks. *Energy Policy* **2018**, *118*, 317–324. [CrossRef]
12. Eurostst Gross Domestic Product (GDP) at Current Market Prices by NUTS 2 Regions. Available online: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10r_2gdp&lang=en (accessed on 20 January 2021).
13. ONS Commuting Patterns in London, East and South East, by Age, 2015 to 2017. Available online: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/adhocs/010104commutingpatternsinlondoneastandsouthe 015to2017 (accessed on 6 August 2020).
14. GLA London Energy and Greenhouse Gas Inventory (LEGGI). Available online: https://data.london.gov.uk/dataset/leggi (accessed on 29 November 2020).
15. TfL. *Travel in London—Report 12 Data*; TfL: London, UK, 2018.
16. TfL. *Travel in London: Report 13*; TfL: London, UK, 2020.
17. BEIS. *The Clean Growth Strategy: Leading the Way to a Low Carbon Future*; BEIS: London, UK, 2017.
18. DfT. Government Takes Historic Step towards Net-Zero with End of Sale of New Petrol and Diesel Cars by 2030. Available online: https://www.gov.uk/government/news/government-takes-historic-step-towards-net-zero-with-end-of-sale-of-new-petrol-and-diesel-cars-by-2030 (accessed on 26 November 2020).
19. Gov.uk Vehicle Tax Rates. Available online: https://www.gov.uk/vehicle-tax-rate-tables (accessed on 4 September 2020).
20. Gov.uk Low-Emission Vehicles Eligible for a Plug-in Grant. Available online: https://www.gov.uk/plug-in-car-van-grants (accessed on 4 September 2020).
21. DfT. *VEH0206: Licensed Cars by CO2 Emission and VED Band: Great Britain and United Kingdom*; DfT: London, UK, 2020.
22. Fontaras, G.; Ciuffo, B.; Zacharof, N.; Tsiakmakis, S.; Marotta, A.; Pavlovic, J.; Anagnostopoulos, K. The difference between reported and real-world CO2 emissions: How much improvement can be expected by WLTP introduction? In Proceedings of the

Transportation Research Procedia, Shanghai, China, 10–15 July 2017; Elsevier B.V.: Amsterdam, The Netherlands, 2017; Volume 25, pp. 3933–3943.
23. DfT. Electric Vehicles: Question for Department for Transport. Available online: https://questions-statements.parliament.uk/written-questions/detail/2019-05-14/HL15730 (accessed on 7 September 2020).
24. Gov.uk. Grant Schemes for Electric Vehicle Charging Infrastructure. Available online: https://www.gov.uk/government/collections/government-grants-for-low-emission-vehicles#ultra-low-emission-taxi-infrastructure-scheme (accessed on 24 January 2021).
25. DfT. *Cycling and Walking Investment Strategy*; DfT: London, UK, 2017.
26. DfT. *Cycling and Walking Investment Strategy: Report to Parliament*; DfT: London, UK, 2020.
27. DfT. *Gear Change: A bold vision for cycling and walking*; DfT: London, UK, 2020.
28. MoL. *Delivering London's Energy Future: Annex D.*; MoL: London, UK, 2011.
29. TfL. Red Routes. Available online: https://tfl.gov.uk/modes/driving/red-routes (accessed on 9 September 2020).
30. TfL. What We Do. Available online: https://tfl.gov.uk/corporate/about-tfl/what-we-do?intcmp=2582#on-this-page-7 (accessed on 9 September 2020).
31. London Councils. The Essential Guide to London Local Government. Available online: https://www.londoncouncils.gov.uk/who-runs-london/essential-guide-london-local-government (accessed on 10 September 2020).
32. GLA. *The Greater London Authority Consolidated Budget and Component Budgets for 2017-1*; GLA: London, UK, 2017.
33. MHCLG. Community Infrastructure Levy. Available online: https://www.gov.uk/guidance/community-infrastructure-levy (accessed on 24 January 2021).
34. Sandford, M. *Local Government in England: Capital Finance*; House of Commons: London, UK, 2020.
35. TfL. Property Development. Available online: https://tfl.gov.uk/info-for/business-and-commercial/property-development (accessed on 9 September 2020).
36. MoL. *The London Plan*; MoL: London, UK, 2016.
37. MoL. *The London Plan: Intend to Publish (Clean Version)*; MoL: London, UK, 2019.
38. MoL. *London Environment Strategy*; MoL: London, UK, 2018.
39. MoL. *Mayor's Transport Strategy*; MoL: London, UK, 2018.
40. Tang, C.K. The Cost of Traffic: Evidence from the London Congestion Charge. *J. Urban Econ.* **2021**, *121*, 103302. [CrossRef]
41. TfL. How We are Funded. Available online: https://tfl.gov.uk/corporate/about-tfl/how-we-work/how-we-are-funded (accessed on 14 September 2020).
42. TfL. *Revised Budget 2020/21*; TfL: London, UK, 2020.
43. TfL. Agenda—Supplementary. Available online: http://content.tfl.gov.uk/board-20200602-agenda-and-papers-supplentary.pdf (accessed on 6 October 2020).
44. LFC. *Raising the Capital: The Report of the London Finance Commission*; LFC: London, UK, 2013.
45. LFC. *Devolution: A Capital Idea: The Report of the London Finance Commission*; LFC: London, UK, 2017.
46. LSDC. *Financing for a Future London*; LSDC: London, UK, 2020.
47. London Assembly. *TfL Finances: The End of the Line?* London Assembly: London, UK, 2018.
48. TfL. *Local Implementation Plan (LIP) 2020/21 Annual Spending Submission Guidance*; TfL: London, UK, 2019.
49. TfL. Local Implementation Plans. Available online: https://tfl.gov.uk/info-for/boroughs-and-communities/local-implementation-plans#on-this-page-0 (accessed on 1 December 2020).
50. Crossrail Funding. Available online: https://www.crossrail.co.uk/about-us/funding (accessed on 7 December 2020).
51. TfL. *Transport for London Green Bond Issuance: Management assertion regarding Eligible Green Project Proceeds*; TfL: London, UK, 2016.
52. TfL. *Transport for London Green Bond Framework 2020*; TfL: London, UK, 2020.
53. MoL. Transport for London Consulting. Available online: https://www.london.gov.uk/questions/2020/0638 (accessed on 3 December 2020).
54. GLA. Hopper Fare Costs. Available online: https://www.london.gov.uk/questions/2018/5347#a-163017 (accessed on 23 September 2020).
55. MoL. Transport for London Business Plan 2019-20 to 2023-24. Available online: https://www.london.gov.uk/questions/2019/0241 (accessed on 3 December 2020).
56. TfL. Scrappage Schemes. Available online: https://tfl.gov.uk/modes/driving/scrappage-schemes (accessed on 24 January 2021).
57. TfL. Funding for Your Borough. Available online: https://tfl.gov.uk/info-for/boroughs-and-communities/borough-funding (accessed on 3 December 2020).
58. DfT. Ultra-Low Emission Bus Scheme: Successful Bidders. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774207/ultra-low-emission-bus-scheme-winning-bidders.csv/preview (accessed on 7 December 2020).
59. London Councils Go Ultra Low Cities Scheme. Available online: https://www.londoncouncils.gov.uk/our-key-themes/transport/roads/gulcs (accessed on 7 December 2020).
60. BEIS. About Us. Available online: https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about#our-priorities (accessed on 24 November 2020).
61. DfT. About Us. Available online: https://www.gov.uk/government/organisations/department-for-transport/abou (accessed on 24 November 2020).

62. HMT. About Us. Available online: https://www.gov.uk/government/organisations/hm-treasury/about (accessed on 24 November 2020).
63. MHCLG. About Us. Available online: https://www.gov.uk/government/organisations/ministry-of-housing-communities-and-local-government/about (accessed on 24 November 2020).
64. Sasse, T.; Rutter, J.; Shepheard, M.; Norris, E. *Net Zero: How Government Can Meet its Climate Change Target*; The Institute for Government: London, UK, 2020.
65. GLA. Government Relations. Available online: https://www.london.gov.uk/about-us/mayor-london/public-affairs/uk-government-relations (accessed on 24 November 2020).
66. GLA. Secretary of State's Response. Available online: https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/secretary-states-response (accessed on 21 January 2021).
67. MoL. About the London Sustainable Development Commission. Available online: https://www.london.gov.uk/about-us/organisations-we-work/london-sustainable-development-commission/who-we-are/about-lsdc (accessed on 24 January 2021).
68. MHCLG. *National Planning Policy Framework*; MHCLG: London, UK, 2019.
69. TfL. *Borough Survey 2019: Progress Report*; TfL: London, UK, 2019.
70. London Councils. About Us. Available online: https://www.londoncouncils.gov.uk/who-we-are/about-us (accessed on 24 November 2020).
71. C40. About. Available online: https://www.c40.org/about (accessed on 24 November 2020).
72. GCM. Who We Are. Available online: https://www.globalcovenantofmayors.org/who-we-are/ (accessed on 24 November 2020).
73. CNCA. Who We Are. Available online: https://carbonneutralcities.org/about/ (accessed on 24 November 2020).
74. CIVITAS. About CIVITAS. Available online: https://civitas.eu/about (accessed on 24 November 2020).
75. POLIS. About POLIS. Available online: https://www.polisnetwork.eu/who-we-are/about-polis/ (accessed on 24 November 2020).
76. UK100. About UK100. Available online: https://www.uk100.org/# (accessed on 24 November 2020).
77. C40. History of the C40. Available online: https://www.c40.org/history (accessed on 24 November 2020).
78. C40. Fossil Fuel Free Streets Declaration. Available online: https://www.c40.org/other/green-and-healthy-streets (accessed on 24 November 2020).
79. C40. Climate Action Planning Framework. Available online: https://resourcecentre.c40.org/climate-action-planning-framework-home (accessed on 24 November 2020).
80. CoM. Signatories. Available online: https://www.covenantofmayors.eu/about/covenant-community/signatories/overview.html?scity_id=11955 (accessed on 24 November 2020).
81. GLA. A City for All Londoners. Available online: https://www.london.gov.uk/get-involved/all-consultations/city-all-londoners (accessed on 24 November 2020).
82. GLA. Talk London. Available online: https://www.london.gov.uk/talk-london/ (accessed on 24 November 2020).
83. TfL. Draft Mayor's Transport Strategy. 2017. Available online: https://consultations.tfl.gov.uk/policy/mayors-transport-strategy/ (accessed on 24 November 2020).
84. TfL. Consultations & Surveys. Available online: https://tfl.gov.uk/corporate/about-tfl/how-we-work/planning-for-the-future/consultations-and-surveys (accessed on 24 November 2020).
85. TfL. *Guidance for Borough Officers on Developing the Third Local Implementation Plan*; TfL: London, UK, 2018.
86. TfL. Open Data Policy. Available online: https://tfl.gov.uk/info-for/open-data-users/open-data-policy (accessed on 24 November 2020).
87. TfL. London Environment Strategy. Available online: https://www.london.gov.uk/what-we-do/environment/london-environment-strategy (accessed on 24 November 2020).
88. GLA. Draft London Plan—Consultation and Minor Suggested Changes. Available online: https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan/draft-london-plan-consultation-and-minor-suggested-changes (accessed on 24 November 2020).
89. TfL. Commercial Innovation. Available online: https://tfl.gov.uk/info-for/business-and-commercial/commercial-innovation?intcmp=55927#on-this-page-0 (accessed on 24 November 2020).
90. Delloite. *Assessing the Value of TfL's Open Data and Digital Partnerships*; Delloite: London, UK, 2017.
91. YouGov. Sadiq Khan. Available online: https://yougov.co.uk/topics/politics/explore/public_figure/Sadiq_Khan (accessed on 7 October 2020).
92. GLA. *Assembly calls on the Mayor to declare a Climate Emergency*; GLA: London, UK, 2018.
93. MoL. *Zero Carbon London: A 1.5C Compatible Plan*; MoL: London, UK, 2018.
94. MoL. Mayor Criticises Government's Proposals to Water Down Green Policies. Available online: https://www.london.gov.uk/press-releases/mayoral/mayor-criticises-proposal-to-weaken-green-policies (accessed on 19 January 2020).
95. London Councils. Climate Change. Available online: www.londoncouncils.gov.uk/our-key-themes/environment/climate-change (accessed on 14 December 2020).
96. ONS. *Population Estimates for the UK, England and Wales, Scotland and Northern Ireland: Mid-2019*; ONS: London, UK, 2020.
97. Wingham, M. *London in Comparison with Other Global Cities*; Greater London Authority: London, UK, 2016.
98. Roth, C.; Kang, S.M.; Batty, M.; Barthélemy, M. Structure of urban movements: Polycentric activity and entangled hierarchical flows. *PLoS ONE* **2011**, *6*, e15923. [CrossRef] [PubMed]
99. BEIS. *BEIS Public Attitudes Tracker—Wave 34*; BEIS: London, UK, 2020.

100. YouGov. GB Environmental Attitudes. Available online: https://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/xlz28wjcpt/YGC_GB_environmental__attitudes.pdf (accessed on 15 December 2020).
101. DfT. National Travel Attitudes Survey—Wave 3. Available online: https://www.gov.uk/govenrment/statistics/national-travel-attitudes-study-wave-3 (accessed on 15 August 2020).
102. YouGov. YouGov/GWPF Survey Results. Available online: https://docs.cdn.yougov.com/dxdo6gss37/GWPF_ClimateCorona_200514/pdf (accessed on 15 December 2020).
103. DfT. National Travel Attitudes Survey—Wave 4 (Provisional). Available online: https://www.gov.uk/government/statistics/national-travel-attitudes-study-wave-4-provisional (accessed on 19 January 2021).
104. YouGov. Following the End of Lockdown, do you Think you Will Use Public Transport More, the Same, or Less than you Did before the COVID-19 Pandemic. Available online: https://yougov.co.uk/topics/transport/survey-results/daily/2020/04/30/62ede/1 (accessed on 15 December 2020).
105. Hill, D. Polling exclusive: Most Londoners blame Covid or Government for TfL Financial Woes, Back LTNs and Are Satisfied with Sadiq Khan. Available online: https://www.onlondon.co.uk/new-polling-most-londoners-blame-covid-or-government-for-tfl-financial-woes-back-ltns-and-are-satisfied-with-sadiq-khan/ (accessed on 15 December 2020).
106. Hill, D. Sadiq Khan Has 21-Point Lead in New London Mayor Opinion Poll. Available online: https://www.onlondon.co.uk/sadiq-khan-has-21-point-lead-in-new-london-mayor-opinion-poll/ (accessed on 15 December 2020).
107. Rogge, K.S.; Reichardt, K. Policy mixes for sustainability transitions: An extended concept and framework for analysis. *Res. Policy* **2016**, *45*, 1620–1635. [CrossRef]
108. Grubb, M.; Hourcade, J.C.; Neuhoff, K. The Three Domains structure of energy-climate transitions. *Technol. Forecast. Soc. Chang.* **2015**, *98*, 290–302. [CrossRef]

sustainability

MDPI

Article

Business Model Development for Temporary Home Renovation Consultancy Centres: Experiences from European Pop-Ups

Minyoung Kwon *, Erwin Mlecnik and Vincent Gruis

Department of Management in the Built Environment, Delft University of Technology, P.O. Box 5043, 2600 GA Delft, The Netherlands; E.Mlecnik@tudelft.nl (E.M.); V.H.Gruis@tudelft.nl (V.G.)
* Correspondence: M.Kwon@tudelft.nl

Abstract: Local authorities (LAs) play an essential role in diffusing home energy renovation measures. However, there are rare business models developed for local authority actions. This paper aims to develop a critical review of the way that local authorities developed business models for pop-up centres where consultants can encourage home energy renovation measures. From 2017 to 2021, participatory research was conducted in collaboration with seven LAs from the UK, France, Belgium, and the Netherlands. Although local authorities could use business model approaches for the development of pop-up home renovation consultancy centres, we noticed that LAs could not apply specific strategies to fit various customer segment groups. Therefore, a traditional business model needs to be investigated further for local authority activities.

Keywords: pop-up consultancy centre; local authorities; home renovation; decentralised approach; home-owner renovation journey; business models

Citation: Kwon, M.; Mlecnik, E.; Gruis, V. Business Model Development for Temporary Home Renovation Consultancy Centres: Experiences from European Pop-Ups. *Sustainability* **2021**, *13*, 8450. https://doi.org/10.3390/su13158450

Academic Editors: David Tyfield, Rebecca Willis and Andy Yuille

Received: 29 June 2021
Accepted: 24 July 2021
Published: 28 July 2021

1. Introduction

The European Union has a 32.5% energy-efficient goal by 2030 and 40% greenhouse gas (GHG) reduction target compared to the 1990 level [1]. Many studies have indicated that an energy transition of the residential sector (e.g., single-family homeowners) is key to achieving this energy efficiency target [2–5]. However, there is a delivery gap for 2020 and an ambition gap for 2030 in the energy efficiency efforts. According to the National energy and climate plans (NECPs) assessment, the net energy savings were 29.4–29.7%. That falls short of the target of 32.5% [6]. There are needs and concerns for realising an investment push, a boost of renovation effort, and a transition [7]. To encourage the adoption of home energy renovations, policy actors at the national, regional, and local levels have developed policies and policy instruments. This has resulted in many examples and theoretical studies—for example, [8–11].

Particularly, residential buildings account for 25% of the total energy consumption in the building sector [12]. Existing housings represent the most significant challenge and opportunities in the carbon and energy-neutral goals. In order to promote home renovations, private homeowners need to be informed and persuaded to use such instruments [13]—for example, Energy Performance Certificates (EPC) [14], financial incentives [15,16], neighbourhood renovation schemes [17], group buying schemes [17], and so on—and authorities need to arrange supporting marketing and campaigns. In European countries, some key barriers to home energy renovations are insufficient awareness of the building users [18,19], biased consultations [20], the decision-making process [21], or difficulty accessing finance and certified experts [16].

European Member States such as Spain, the Netherlands, and the UK support a decentralised approach for low-carbon and energy reductions, and local authorities (LAs) are often considered responsible as a mediating facilitator [22–24]. LAs, as mediating facilitators or energy advisors, can be impartial and give a sense of trustworthiness to homeowners [25]. Therefore, LAs have developed approaches to increase the awareness of

the possibilities and advantages of the energy efficiency measures among homeowners and facilitate easy access to these measures and financial support [26,27]. In this regard, localism is a pragmatic approach to offering equal access to citizens and developing opportunities for organising a local supply.

In this framework, we focus on such local approaches, and we investigate the development of local pop-up energy consultancy centres in renovation target areas. Such centres have been increasingly used by local authorities [28] for various reasons: a pop-up centre can potentially attract more people than a centralised consultancy centre, LAs can operate close to the residents, and LAs can offer equal access to renovation information as well as connect with the local drivers and local supply. Compared to fixed renovation consultancy centres, a pop-up concept can attract people via nudge marketing and as a temporary means [29].

The successful implementation of pop-up home renovation consultancy centres requires insights into the added value, marketing channel, supply, and finance and organising this as a continuous effort (instead of "single, incidental" campaigns). Moreover, since LAs usually do not provide or carry out the technical measures themselves, their implementation requires (facilitating) cooperation between the supply chain, consultants, and homeowners. This makes it highly relevant to analyse pop-up centres through the lens of business models. The business model focuses on creating, delivering, and capturing values, consisting of customer segments, value propositions, communication channels, customer relationships, key activities, key resources, key partners, revenue streams, and the cost structure [19].

This paper aims to develop a critical review of the way that the local authorities developed business models for pop-up centres where consultants can encourage home energy renovations. From 2017 to 2021, participatory research was conducted in collaboration with seven LAs from the UK, France, Belgium, and the Netherlands. Section 2 describes the research method used in this paper and the nine pop-up centres developed by the LAs that we considered as cases. Section 3 illustrates the application of business model canvases for pop-up centre development based on LAs' self-reporting data and observations. Section 4 comprises a discussion of a gap we observed when using business model development factors to assess public sector activities, a way of using the pop-up centre as a communication tool, and the limitations of this study. Section 5 offers recommendations for LAs to develop a successful pop-up centre that fits their local policy initiatives and goals.

2. Methods

2.1. Participatory Research

An advantage of participatory research (PR) is integrating theoretical perspectives to practice through a collaborative process [30]. According to Cargo and Mercer [31], PR can improve the research quality by reducing the reporting bias and measurement error and increasing recruitment. Non-academic partners can get benefits by adopting a research protocol [32]. Many researchers have suggested using business model approaches for developing home renovation consultancy or one-stop shops [8,33–35]. The studies are often focused on supply sides or private parties, or the results stay at the academic level. This paper deals with the pop-up consultancy centre developed by local authorities, and we seek to investigate the knowledge-to-action gap through the participatory research method. We had a partnership with seven local authorities from Belgium, the Netherlands, the UK, and France. Through the partnership, we could enhance the research capacity and widen the dissemination of the theoretical knowledge.

2.2. Business Model Canvas

The business model canvas (BMC) developed by Osterwalder and Pigneur [36] is widely used due to the ease of practical application and ease of presentation of its complex components [37]. The BMC consists of nine building blocks: customer segments, value propositions, communication channels, the expected relations with customers and partners,

key activities, resources, key partners, revenue stream, and cost structure. It gives a practical instrument that allows organisations to develop a business model by focusing on value creation. LAs are unfamiliar with developing business models in practice. The BMC is easily adaptable in various contexts, such as business, design, engineering, and sustainability sciences [38]. For these reasons, a modified model has been applied to the business model of non-profit organisations for public services [39]. In this study, the nine factors are redefined as described in each subsection. The LAs tried to reflect the nine factors for the pop-up consultancy centre development.

2.3. Data Collection

We collected comprehensive data related to LAs' business model development and the way LAs apply the model to the pop-up centre development. The data were collected through self-reporting and group-level assessment. The focal point of the data analysis and interpretation presented in this paper is summarising the qualitative information, strengths, and challenges for each business model canvas factor: customer segments, value propositions, communication channels, customer relationships, key activities, key resources, key partners, revenue streams, and cost structure. At the same time, the LAs monitored the number of visitors during the pop-up opening period. Additionally, they provided quantitative data such as the opening time, investment, and exploitation costs for the pop-up centres.

2.4. Comparative Assessment

Based on the qualitative and quantitative data, we analysed the effectiveness of the pop-up centre. The SWOT analysis was a useful method to investigate the pros and cons of each pop-up. A card sorting method [40] was used to classify the categories and to understand the LAs' experiences. For the quantitative data analysis, we used an ANOVA test. Since the comparing groups were more than 3, an ANOVA test was suitable to investigate whether there was a difference of effectiveness among the pop-up centres.

3. Case Studies

Seven local authorities developed and operated nine pop-up consultancy centres in different forms between 2017 and 2019 (see Figure 1). Pop-up A was a greenhouse to promote services and get closer to homeowners in target areas. The pop-up was developed with a relatively small effort. Pop-up B was elaborately designed as a tiny house. The design was intended to look attractive and to make people curious. Pop-up C was a standing banner with a low-cost pop-up idea. It was small enough to place inside libraries and council buildings. LAs expected that this form might reach out to more residents. Pop-up D was also a form of a house. The solar panels and wooden cladding referred to sustainable nature. Pop-up E was an automobile form with high mobility, so it was suitable to be located anywhere. Pop-up F was a portable container as a mobile office. That mobile pop-up stayed in one place for around one week. People could visit without making an appointment. Pop-up G was located in a shopping mall. The location ensured a constant stream of pedestrians. Pop-up H was in the waiting area of an office. People could search the renovation information and services offered by a LA through the standing browsers, which was called an interactive module. Pop-up I was located in a vacant commercial place in a local shopping centre.

Overall, mobile pop-up centres were placed in public spaces, outside the city centre, open areas in the neighbourhood, or shopping centres. In contrast, fixed-location pop-ups were accommodated in a vacant space in a shopping centre or an office.

Figure 1. Overview of the pop-up consultancy centres.

4. Results: Business Model Canvas Applied by Local Authorities

4.1. Customer Segments

The "Customer segments" building block identified expected customers for the pop-up [36]. Reflection on this building block guided LAs to understand the characteristics and types of end users in target areas in order to help identify different relationship types and various channels to reach out to these customers. The LAs first jointly participated in a workshop in June 2017 to discuss target customers, and consequently, they deployed a common understanding for an integrated segmentation approach. The LAs segmented the type of homeowners and their possible core characteristics into seven distinct categories based on family composition, education, and life circumstances as follows:

- Young families. These homeowners are young who have recently bought a house. They are potentially high energy users who may be receptive to piloting technologies that could save them energy and money.
- Empty nesters. With children who have recently left home, these homeowners may want to renovate their existing home and may have some savings to make the property

more comfortable. Alternatively, these homeowners may want to move to a new home and make energy upgrades.
- Existing adopters. These homeowners have already adopted at least one low-carbon technical measure and may be willing to try other renovation measures.
- Homeowners undergoing major life changes. For example, these homeowners are experiencing change, for example, moving home due to a new job or looking to sell their property due to a change in life circumstances.
- Highly educated, financially successful families. These homeowners may have some disposable income in order to invest and may be more willing to take a risk. They may also be more environmentally conscious and willing to trial technologies for their environmental benefits. These homeowners may be short of time and be receptive to timesaving/unburdening solutions.
- Homeowners who are receptive to the renovations of their neighbours. Word of mouth and visually seeing what renovations a neighbour has made can make homeowners more willing to undergo the same renovations. Therefore, these homeowners would be more receptive to the broader roll-out of these technologies rather than the initial pilot targeting.
- Homeowners who are confronted with fuel poverty. These homeowners struggle to pay their energy bills and may be vulnerable to the effects of living in a cold and possibly damp, unhealthy home as a result.

Although LAs categorised or aimed to reach the customer segment groups listed above, their work did not go as planned in practice. For multiple LAs, it was difficult to obtain specific data of people living in certain target areas, either because these data were not available (in the right format) or because they lacked time to collect and analyse such data. For instance, the LA for pop-up A did not use the customer segments; instead, they considered other factors, such as the construction year of a house and the dwelling typology. In practice, most LAs perceived that most visitors were young people or families in mobile pop-ups. The young families were the most accessible group to reach, since they often started a cohabitation (getting married, new-borns, or buying a house). Another example, the LA for pop-up I targeted only a low-income group, since their houses often needed renovation urgently, while they could not get financial support or lack information.

Overall, LAs considered the target area more than guiding the customer segment. They used the following characteristics to point out target areas and to locate a pop-up centre.

1. Degree of individual homeownership in the area;
2. Commonalities in house characteristics: a certain standardisation of communication can be developed in such cases;
3. Demographics in the area: to assess expected motivation of households;
4. Building quality and previous renovation activity in the area: to assess the need or dynamics for additional measures;
5. Energy use in the area: a relatively high energy use can lead to higher CO_2 savings after renovation or reduction of fuel poverty;
6. Availability of demo exemplars, political support, and/or citizen support in the area.

4.2. Value Propositions

Value propositions are the products or services that create value for customers. Value propositions deal with what added value the pop-up centre will bring to the customer segment. A main consideration of LAs was proximity of the consultancy centre. LAs reasoned that proximity would lead to increasing awareness, providing information more effectively and demonstrating low-carbon technologies to accompany the homeowner during their (nearby) customer journey. Every LA applied tailored and personalised advice and coaching, covering different homeowner renovation journey stages [27]. The main strength of the mobile pop-ups was the ease of approach to diverse neighbourhoods. On the other hand, they had to be prepared to also target multiple types of homeowners. The

fixed pop-ups had the theoretical advantage of addressing the values in a fixed target area and being able to anchor on these values with specific actions.

Theoretically, LAs were supposed to use different strategies and services according to the customer segments. However, over fifty percent of the participated LAs did not take other actions for segmented customers. We observed that customer segmentation approaches did not always match LAs' assumptions and needs. Particularly the mobile pop-ups could encounter all types of households, depending on their very short-term locations. For some fixed pop-ups, a primary survey or study about visitor types in advance provided a piece of information for each segment, which could be completed once the pop-up started its activity on the location, and consultants could collect supporting data.

4.3. Communication Channels

"Communication channels" indicates not only channels but also tools or activities that were used to attract homeowners and to promote renovation measures. LAs developed specific communication to reach homeowners to consult the pop-up services. All LAs used online and offline promotion channels, such as postcards, ad envelopes, digital and local newspapers, leaflets in the neighbourhood, supporting events, social networks, and websites. LAs collaborated with the local press, using press releases and articles in local municipal newspapers to create media attention. LAs brought printed publications in regional service centres, shops, residences of active inhabitants, and so on. The majority of LAs stated that printed advertisements or events were more efficient in inviting homeowners than online promotion.

For fixed-location pop-ups, LAs had to use more and various communication means than for mobile pop-ups due to the need to attract a more limited number of citizens on a regular basis. The mobile pop-up could be a communication means by itself by being located in target areas or crowded areas where people pass by the most.

4.4. Customer Relationships

"Customer relationships" addresses how the relationship with customers is kept during and after visiting the pop-up centre. LAs offered multiple options to maintain customer relationships, such as follow-up calls, offering tailor-made advice, and invitations to attend or visit demonstration projects. For instance, visitors could get renovation information about their housing conditions and available subsidy from renovation coaches. A web-based registration tool was also actively used to make a reservation for an office visit. One LA managed the follow-up consultancy by itself; others had to rely on sometimes-hired consultants to systematically collect data and maintain relations.

However, it seemed that LAs could not keep this customer relationship for the follow-up consultancy in the long term. One important barrier was that LAs did not initially relate "customer relations" to "key activities". Afterwards, they reflected that this would also have had implications on "key resources", such as a customer relationship management system and data exchange agreements. Another hurdle was that homeowners needed technical information and expert knowledge, which LAs might not offer in a particular stage (e.g., realisation, contract type, and so on). For that reason, most LAs started collaborating in a later stage with other "key partners", such as energy cooperatives, citizen associations, or non-profit organisations, to provide tailor-made support and personalised advice and follow-up customer relations.

4.5. Key Activities

"Key activities" address the LA service's activities and assets (financial support, knowledge, and events). To be able to evaluate the pop-ups as a policy instrument, activities were also coupled with performance indicators. It was evident that LAs provided many products and concrete services in the pop-up centre.

All pop-up types provided necessary information about home renovation, such as renovation measures, advice and coaching, and financial incentives. We observed no

specific differences in the way the consultancy was brought up by staff in the staffed pop-up centres, but there were many differences regarding the type and characteristics of supporting activities. LAs conducted various activities, such as energy breakfasts, open house events, an energy-saving market, and workshops, as well as communication activities through newsletters, websites, social media, flyers, and e-mails.

The detected promotion activities were:

- Distributing leaflets in the neighbourhood, town halls, and so on
- Organising and participating in events, workshops, and local fairs social media
- Combining communication and scheduling with an online platform
- Providing on-site advice
- Serving coffee and tea
- Moving around per target area, sometimes even visiting each district twice
- Organising door-to door letters
- Staffing with well-trained and knowledgeable energy coaches
- Sending invitations, flyers with contact detail to homeowners
- Developing their own communication skills
- Establishing working methods with an adviser or energy coach
- Establishing collaboration with neighbourhood ambassadors
- Distinguishing and managing temporary and permanent activities
- Providing personalised support
- Developing promotional activities in fixed-location pop-up centre
- Providing thermographic photos
- Setting up displays, amongst other demonstrations of technological solutions

Compared to fixed pop-ups, mobile pop-ups focused more on activities for attracting new visitors besides providing necessary information. LAs experienced an unbalanced number of visitors and coaches, depending on quiet or very busy days and actual promotion in these periods. Although LAs applied many activities, it was a challenge to check its impact on increasing homeowners' awareness by using performance indicators. Overall, LAs had conducted and tested as many activities as possible to promote the pop-up without studying the possible effectiveness or evaluation method in advance. Moreover, LAs found that it was difficult to identify communication activities per customer segment Thus, no direct relation with the "customer segments" building lock was achieved in practice.

Nevertheless, there were meaningful activities in this study that could be qualitatively related to the success of the pop-up consultancy activities. First, some LAs invested in thermographic photos to show visitors how well the roof or façade of their house was insulated. Many homeowners were interested in checking the thermographic photos in the pop-ups. As this type of information was directly related to the thermal insulation deficiencies of their houses, it triggered them to think about home renovation measures. Second, collaboration with local stakeholders was important to align local communities and to support local events. Moreover, local stakeholders were willing to develop specific activities to support the "local anchor" or even to develop pop-up centres themselves. Third, some pop-ups successfully focused on group purchases. Group purchases could be organised relatively easy due to the exhibition of the proposed solution in the pop-up centre. Finally, it could be qualitatively observed that visitors were also particularly interested in smart metering and demo homes in the area. Overall, LAs perceived that personalised information worked better than informing a general idea about home renovation.

4.6. Key Resources

"Key resources" indicates the most important assets or inputs utilised by the business model owner. Generally, it deals with what kind of human resources, materials, and equipment are needed. In the previous section, we elaborated what concrete activities were needed, and all of these related to specific resources that needed to be made available or delivered in the pop-up centre (for example, for informing, demonstrating, advising, and

selling specific measures aimed at the insulation of roofs or glazing, showing technologies and products, offering tailor-made financing schemes, and so on).

During the preparation phase, LAs needed to organise an internal management team that could only focus on the pop-up centre implementation. Having knowledgeable energy coaches and well-trained advisors were important human resources. A lack of expert knowledge sometimes made staff feel insecure when offering information. LAs reacted to this either by hiring experts, offering training, or explaining that it is unnecessary that they answer everything by themselves; they can also refer the residents to the right person or organisations. Thus, the LAs had to make sure that they organised a training course for energy coaches or collaborated with experts and third parties. Overall, LAs also tried to integrate the use of online consultancy tools at the pop-up to support consultancy activities.

4.7. Key Partners

Key partners are various stakeholders that help the business model work and contribute to the success of the business. Key partners were the needed network of actors and partnerships that were not part of the LA or consortium. Overall, three types of key partners were detected: public, private, and citizen actors. Public actors were national and regional authorities, other local authorities, public welfare, and multiple city departments. They contributed, for example, with providing national information, regional co-funding, co-staffing, and specific information for certain target groups or advice topics. The detected private actors were local contractors, SMEs, energy-net managers, and installers. They mainly contributed to providing information, displays, and demonstrations of technologies and services. For example, in one case, a contractor produced a mobile pop-up on demand. The detected citizen actors were local ambassadors, neighbourhood committees, and students from a technical school. The LAs reasoned that experienced homeowners were a vital asset to convince new homeowners to renovate. Students were engaged in developing technology demonstrations for the pop-up.

LAs held e-tendering to procure substantial activities from private or citizen actors and searched partners from different actor groups, sometimes relying on their voluntary contribution. At the national level, some LAs also collaborated with grid operators and energy agencies. LAs mentioned that working together with other city departments was not easy, because their goals were different. Private actors were often helpful, because they had expert knowledge and shared resources, but it could be difficult to ensure residents would get the right information. As a LA, it was important to ensure they were objective and not biased. In this regard, collaborating with SMEs was a challenge, because LAs are not allowed to recommend specific supply-side actors as neutral actors. In the later stages of the business model development, LAs sought to work more closely with "emerging" new partners, such as local energy cooperatives and associations that target specific areas or homeowner assemblies.

4.8. Cost Structure and Revenue Streams

The "cost structure" means the costs that occur through the business preparation and operation phases. The main goal is to minimise costs and maximise values. "Revenue streams" means the earnings that a business generates from its activities and channels. Here, the costs of developing and sustaining the pop-ups and creating its revenues were considered. In a good business model, the costs and revenues should balance.

The LAs all relied on European project funding to develop their pop-ups. Visitors could get information in the pop-up centre free-of-charge, which was also funded by project subsidies. Furthermore, the LAs aimed to keep the costs as low as possible and invest in information provision in various ways, mainly (e.g., face-to-face with staff, videos, and leaflets) to keep residents interested in the pop-up. SMEs consortiums were willing to provide their product samples for free so that LAs could benefit from that.

LAs planned to install a paid advice and consultancy for homeowners. However, this activity was new for both homeowners and LAs, and it was therefore considered

inappropriate to pursue. Thus, the LAs did not create any revenues from the pop-up centre. In Figure 2, the range of total cost varied due to the different pop-up running hours, staffing costs, and type of pop-up centre. In order to generalise the data, we compared the hourly cost base. The staffing cost influenced the total cost of the pop-up centres. The total and operating costs were significantly different whether it was a staffed centre or not. Pop-ups C and H showed considerably low operating costs compared to the other pop-up centres. Although pop-ups E and F were staffed consultancy centres, they also showed relatively low operating costs, since LAs did not hire temporary coaches or advisors.

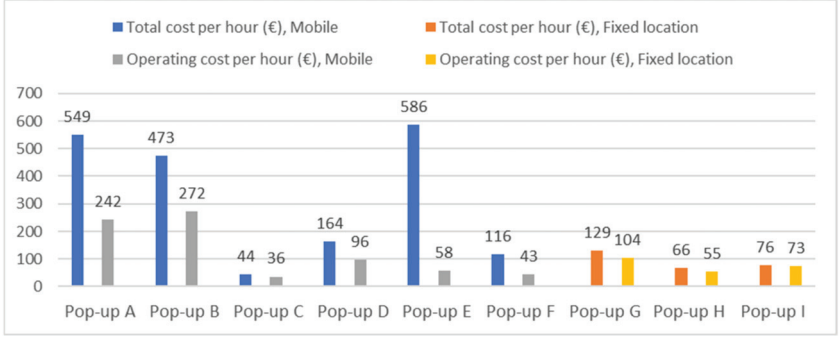


Figure 2. Pop-up cost per opening hour.

In the future, LAs will need to find creative ways to reuse or change existing pop-ups to reduce costs and ensure consultancy continuation. The LAs concluded that this would require the deeper engagement of other public bodies, public–private partnerships, cooperatives, and possibly actors to ensure action after the follow-up consultancy. Therefore, a future strategy might be to develop local renovation hubs and assess what bottom-up initiatives in target areas can be supported using the already set pop-up with the help of local participation and/or home renovation deployment.

The LAs speculated that future revenue sources could be payments for advice, consultancy for homeowners, a fee for suppliers of low-carbon technologies or services, lease or rental of the pop-up, government contributions, and so on. The LAs expected other LAs or private parties to develop similar pop-up centre concepts in the near future.

5. Evaluation of Pop-Up Centres

5.1. Effectiveness of Pop-Up Centres

The LAs applied the BMC to develop their pop-up consultancy centre, and there is no significant difference in the BMC approach. Nevertheless, each LA chose different locations for their pop-up centre, the type of pop-ups, and opening hours. Since every pop-up had different opening hours, it was a challenge to compare the effectiveness. Therefore, we collected information about the total opening hours and the number of visitors to analyse the effectiveness of the pop-up centres. A one-way ANOVA revealed a statistically significant difference in the pop-up centres ($p < 0.001$). In Figure 3, pop-up A was the most functional effective model in terms of the number of visitors, while pop-up C was the least functional effective one.

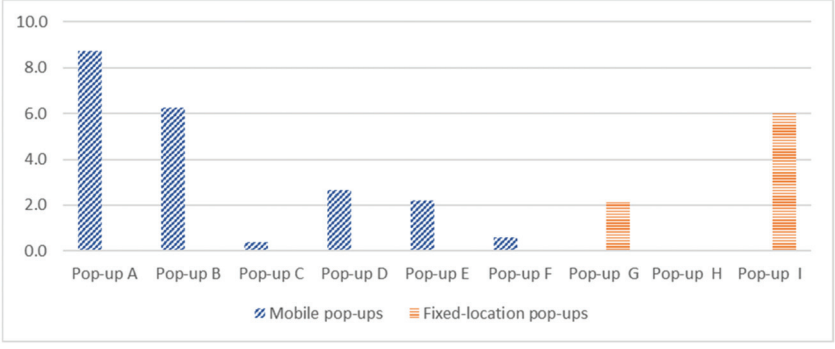


Figure 3. Effectiveness of the pop-ups based on the number of visitors per hour.

5.2. SWOT Analysis

We used a SWOT analysis to investigate the pros and cons of each pop-up (see Table A1). We observed that the results were quite similar to each other, because the LAs followed the business model canvas and used similar approaches. Therefore, we classified the results according to mobile and fixed-location pop-ups.

5.2.1. Mobile Pop-Up Centre

The advantages of mobile pop-ups are mobility and outstanding appearance. The shape of the short-term mobile pop-ups was a free-standing object and a transformed caravan. It was relatively easy for LAs to choose good locations and easily experiment with various places, such as remote neighbourhoods from crowded areas. The LAs with big size and the massive weight of pop-up centre had the challenge to transport the pop-up centre to store it. LAs recommended that the size and weight of the pop-up should not be too big for easy mobility. A mobile pop-up centre can attract many visitors and get attention from citizens in the visited neighbourhood.

The advantage of a mobile pop-up is that LAs can reach a different audience than the usual one. The mobile pop-ups usually stay on the one site two times per week to avoid people missing visiting the pop-up centre. The mobile pop-up centre could attract many visitors and get attention from citizens in the visited neighbourhood. It also had easy accessibility for homeowners and mobility for LAs.

5.2.2. Fixed-Location Pop-Up Centre

The fixed-location pop-up centre had the benefit that people could visit the centre whenever they had time. Moreover, visitors could stay longer and got consultants or individual advice in a quiet atmosphere. It means that a fixed-location pop-up needs to facilitate knowledgeable advisors or experts. For this reason, this pop-up also could be used as an office for follow-up consultants or personalised building diagnosis rather than promotion activities. In addition, LAs perceived that a long-term presence could lead to trusted relationships between organisations and citizens in a targeted area.

Nevertheless, there was also a challenge of bringing homeowners to the consultancy centre before this pilot project because of no attractiveness of the pop-up and the wrong location selection, which were not many passengers around. The pop-up centre in the city centre did not get attention from people, because pedestrians in the city centre have different purposes, but the pop-ups near the shopping mall worked better. We observed that it was better to be closer to homes.

6. Business Model Development by Local Authorities: Discussion and Future Research Opportunities

We discuss some specific aspects of the LAs' business model development—as exemplified here for the development of pop-up consultancy centres—focusing on the differences in applying the public or private sector model.

6.1. Public Sector Business Model Application

A business model can be a useful tool to achieve goals such as business growth and profitability and capturing values [41], and the model developed by Osterwalder and Pigneur [36] has widely been used for profit generation. Sanderse, et al. [42] and Hvenmark [43] reviewed that applying the business model in the non-profit sector may lead to misunderstandings because of a first-profit aim. Hence, we have to consider the different characteristics of public sector business and its consequences. Previous studies on developing consultancy centres or one-stop shops were often limited to addressing the issue from a supply-side perspective [35,44]. This paper offers new insights to define and translate the business model elements in the framework of the management of a "business" by a LA. In this case, the main goal of the business is the operationalisation of an instrumental policy means.

In traditional business models, identifying and classifying customer segments is essential to understanding their needs and providing the right sources through the right channels [45]. However, for policymakers, the customer is often more generally considered as the "citizen". While generating revenue is a significant element for a private sector actor and its business, a public actor can rely on public money for experimentation within certain conditions that contribute to local and regional development. That is why, in this study, LAs did not necessarily seek commercialised partnerships nor revenue-generating opportunities. A third-party business-funded model could be used [42], since the LAs were funded by European project budgets and helped by other public, private, and citizen actors with the view of achieving successful experiments. Nevertheless, our results supported the study by Weerawardena, et al. [46], arguing that the public sector needs to distinguish different value creation strategies and captures, since these are two different streams in public sectors.

In practice, LAs can also be more affected in their business model development limitations by often changing political parties and mandates; traditional business might have the advantage that management is more stable and that businesses and operational activities can be developed to a better suitably in the long term. LAs reported that many important decisions were influenced by a central or national government or political parties, and they had to coordinate and communicate with them constantly. For example, selecting key partners and resources was considered more complicated than when done by private sectors, and LAs did not have much freedom to choose key resources. It is not a negative condition; however, LAs experienced that they should have more freedom in decision-making to fit local and regional conditions. Additionally, LAs perceived a need for additional developments in parallel for supporting marketing plans, local ambassadorship, and cocreation.

From the research experience, the model canvas was thus mainly useful to guide LAs in the pop-up centre development process, motivating their integrated thinking from the viewpoint of the homeowner and discussing and establishing cocreation opportunities with other actors.

6.2. The Interpretation of Public Communication in the Business Model

As it often goes with innovations, they come along with the need for a lot of communication. Previously, this paper discussed the used communication channels. Public sector communication can also be different in nature compared to when others organise this communication. For example, Glenn [47] identified the core communication activities for the public sector. They are consultation, advertising marketing, media relations, strategic

communication planning, and so on. The communication channel in the "traditional" business model canvas mostly refers to promotion and advertising activities. So, the LAs classified their activities based on digital and nondigital advertisements, and they used various methods to promote the pop-up centres. The effective communication channel needs to be matched with the goal of the message [48] and a customer segment. Most LA web communications about home renovations and energy savings do not address a specific customer segment but, more in general, the "citizen". Digital means like social media, e-newsletters, and e-mail have the potential to be directed to specific citizens, but LAs rarely use this potential due to a lack of data or privacy concerns.

The research indicated that nondigital media were perhaps more effective for attracting citizens. Nondigital communication such as newspaper, leaflets, and door-to-door visits can significantly influence homeowners as a short-term means, while it takes place in real-time. In practice, it is challenging to investigate which tool worked effectively. This evaluation process was not done for this study. A more elaborate evaluation process could help LAs know whether a specific channel effectively delivered their message and reached homeowners. In view of the ongoing digitisation and development of local government e-services, the digital/nondigital divide is an interesting topic for future research.

It should be noted that advertising is not a core activity for the public sector. Therefore, we need to look at the concept of the communication channel on a broad scale and also think more holistically about how communication key partners and engaged citizens can be involved in the business model development. According to the classification by Howlett [49] and Glenn [47], a pop-up centre can be used in the procedural domain, which is focusing on individuals' or groups' behaviour changes. There has been an overall public sector change from holding power over citizens to holding power with citizens [50], emphasising the importance of listening to homeowners' needs and the participation of citizens. In this regard, the LAs worked together with local ambassadors and neighbourhood committees during the pop-up operation phase. Through this approach, LAs could easily contact residents, and people felt familiar with the members at the pop-up centre. Thus, the collaboration with citizen actors contributed to reaching diverse customer groups in a target area.

6.3. Observed Limitations Regarding the Use of the Business Model Canvas and Opportunities for Future Research

In this research, we noticed that LAs could not apply specific strategies to fit various customer segment groups. Although they were aware of the characteristics, it seemed to be a challenge to categorise certain types of visitors based on recognised customer segments. Nevertheless, LAs considered the age of houses, ownership structures, and demographic information to decide suitable target areas. Furthermore, it may be essential for customer segmentation to include behaviour and life patterns from a psychological point of view [31], because awareness and behaviour changes are related to the psychological impact. This could, for example, be realised by conducting a pre-survey with citizens in the target area to understand homeowners' needs and priorities.

Second, the LAs needed to complement the business model development with additional means, such as communication, cocreation, and marketing plans. A strategic and performance-based approach can be recommended for identifying promotion activities related to using policy instruments, distinguishing between temporary and permanent key activities. The promotion activities were now too generic, but the value of real interactivity with citizens was regarded as higher than for virtual activities.

Many LAs highlighted the importance of an internal management team that can only focus on the pop-up centre development and use. An internal management team can work on schedule management, promotion, and communication activities. This essential component and the transaction costs for developing a new "business" are often neglected in business model development.

This research addressed an interesting new approach where pop-ups were used as a short-term activity embedded in existing shops. This shop-in-shop concept could also be further explored, for example, to support one-stop shop developments.

Last, this study did not assess the willingness to adopt home renovation measures and satisfaction with the pop-up centre. For future research, listening to visitors' opinions and needs through a survey may help keep a customer relationship and improve the pop-up centre by understanding visitors better. Such evaluations are also instrumental for assessing the effectiveness of policy instruments.

7. Conclusions

This paper investigated the application of the business model canvas to develop pop-up home renovation consultancy centres by local authorities. The research shows that the pop-up centre idea can be used as a decentralised policy instrument to spur the adoption of energy renovation measures and low-carbon technologies by citizens in target areas. Local authorities could use business model approaches for the development of pop-up home renovation consultancy centres. The business model development approaches defined in the previous literature certainly have their merits, while their application in practice by public actors can also be limited.

The use of the business model canvas led to numerous insights. First, local authorities found that it was very difficult to collect sufficient data about customer segments. In such cases, the use of building and target area characteristics may become more dominant for identifying the possible measures to promote instead of customer values. In practice, the business model development is always a work in progress, not necessarily positioned at the beginning of the development process. For example, some developed pop-ups also collected information about customer segments only once they were developed or installed. This could lead to remodelling the business model and optimising the business model building blocks.

Homeowner consultancy pop-ups do not attract sufficient visitors by themselves. LAs need to invest in a wide range of communication channels, activities, and resources. In target areas, traditional offline communication might still be more effective than online communication. The key activities of a pop-up consultancy centre reached far beyond offering consultancy. On the one hand, the staff needed to be trained to deal with technical issues, as well as human interactions. On the other hand, a large range of supporting activities was also required to attract visitors. It can be recommended to discuss and establish key performance indicators in an early stage per needed activity in order to be able to evaluate the pop-up as a policy(-supported) instrument.

Due to many different variables for each pop-up, it was a challenge to figure out exactly which factor directly influenced the effectiveness of the pop-up centre. Even though there was no optimised pop-up case or a recommended type in this study, we propose that LAs should consider the following issues for a successful pop-up consultancy centre based on our findings.

- A mobile pop-up consultancy centre has high flexibility and can reach various types of homeowners. Thus, this pop-up can be used as a promotion tool due to the attractive form.
- A fixed-location pop-up can be used as a long-term consultancy centre providing in-depth and personalised advice and coaching. For this pop-up, LAs should facilitate knowledgeable staff or experts.
- LAs should consider family composition, education, life circumstances, lifestyle, and personality to classify customer segments.
- Cocreation and collaboration with stakeholders should be organised in different stages.
- Internal collaboration is essential in terms of schedule management, promotion, and communication activities.
- The involvement of civic actors is essential to reach local citizens in a target area.

- A marketing mix is helpful in the early preparation stages; however, sustaining LAs' activities is also crucial for a long-term plan.
- A visitor survey should be conducted to understand segmented customer groups better.

Following up customer relations is also a specific point of attention: if pop-up visitors cannot be led to follow-up consultancy and further renovation actions, the pop-up will most likely not be a success as a policy instrument, which means not leading to sufficient increased renovation measures. Following up visitors has implications on the way the business model is composed: it can strongly affect the needed activities, resources, and partners. The one-stop shop model, where one contact point follows the customer throughout the whole renovation journey, was difficult to achieve for local authorities, as they are currently limited in the way they can help homeowners during contracting, implementation, and quality assurance. This would require a stronger public–private and/or public–citizen collaboration with, for example, energy cooperatives, non-profit organisations, or citizen associations. In the long term, LAs would prefer market and/or citizen parties that take over pop-up home renovation consultancy centres and services.

Author Contributions: Conceptualisation, M.K.; methodology, M.K. and E.M.; writing—original draft preparation, M.K.; writing review and editing, M.K., E.M. and V.G.; and project administration, E.M. and V.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the European Fund for Regional Development and the Provinces of South Holland and West Flanders under the project Interreg 2 Seas "Triple-A: stimulating the Adoption of low-carbon technologies by homeowners through Awareness and easy Access", grant number 2S02-029, and the APC was funded by Delft University of Technology.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data are not publicly available due to legislation.

Acknowledgments: The authors would like to thank all Triple-A contributors and partners from seven local authorities: 2 regional (Hauts-de-France and Kent County Council) and 5 city-scale (Antwerp, Breda, Mechelen, Ostend, and Rotterdam).

Conflicts of Interest: The authors declare no conflict of interest, and the funders had no role in the design of the study; in the collection, analyses, or interpretation of the data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A

Table A1. Overview of Strengths, Weaknesses, Opportunities, and Threats of Pop-Up Centres.

Pop-Ups	Strengths	Weaknesses	Opportunities	Threats
A	• The attractive form of pop-up (greenhouse) • Collaboration with companies • Combination with information sessions, workshops, and fairs • Organising info-meetings with neighbourhoods	• Limitation of reaching range of residents due to the size of the city • Difficult transporting the pop-up • Need approval to use a certain location • No cocreation • Not used very often but joined with a stand provided by the fair organisation.	• Easy mobility • No insurance needed • Easy storage (dismountable) • Location of the pop-up (close to the entrance of a supermarket)	• Complains from visitors but no relation to home retrofitting

Table A1. *Cont.*

Pop-Ups	Strengths	Weaknesses	Opportunities	Threats
B	• Appearance of the pop-up • Collaboration with energy cooperative and suppliers	• Need energy coaches due to unexpected success	• Mobility allows the pop-up to be used in many locations, including other municipalities	• The mobile concept needs additional resources for reaching locations
C	• Combination with social media • Ensuring local schemes for energy • Low-cost investment • Collaboration with local authorities, energy and water companies, and contractors	• Non-staffed, and visitors can take information packs. • Different needs from visitors (materials vs. consultation)	• Reaching a wide range of residents due to the location of pop-up. • Inviting local SMEs to participate • Folder concept provides the most accurate information on funding to residents	• People are reluctant to provide details or sign up for questionnaires. • Some residents wanted to discuss other council services
D	• Easy mobility • Showing the thermographic aerial photograph of the city roofs • Saving cost to construct a stand in local trade fairs for construction, renovation, and home improvement. • Collaboration with local associations, actors, and initiatives	• Requiring careful planning about the size and the need to visit neighbourhoods • Less attractive to children (a group of young families) • Importance of quality of advice and subsequent follow-up	• Combination with events and other project • 4 coaches to support citizens • Attractive shape of the pop-up • Distinction of activities between temporary and permanent activities for efficiency of the pop-up use. • Potential for stronger collaborations with other departments, supply-side actors.	• Located in neighbourhoods brings less attention from visitors. • Staffing is challenge during winter period, and no visitors.
E	• Conducted visitor surveys during the pop-up opening • Well organised and trained renovation coaches • Personalised support is provided • Easy mobility allows to be placed in many locations for consultation and reach different types of residents	• Consultants should know how to advise homeowners.	• Combined with workshops or theme breakfast • Combined the pop-up with the habitat fair) • Combine it with taking thermographic pictures • Having models to provide a better view to homeowners what is possible to do	• Many visitors come and relatively a smaller number of consultants

Table A1. *Cont.*

Pop-Ups	Strengths	Weaknesses	Opportunities	Threats
F	• The proximity and easy access for visitors • Collaboration/ cooperation with supply sides for the group purchase (PV, insulation, green power) • Organising information session, collaboration between private (Fluvius) and public (the municipal department).	• Installation of a large container (6 × 3 m) • Transporting the pop-up office • Visitors cannot make an appointment	• A closer cooperation with the vicinity centres and/or neighbourhood initiatives, in order to reach more people • Combined promotion/communication campaign • Cocreation with schools (a good opportunity for schools to train students)	• Need permission from the city administration
G and I	• Collaboration between internal municipal programmes and departments • Collaboration with private/public intermediaries achieved to cover detailed advice, implementation, and customer relations • Development of communication skills • Anchor of the Municipal neighbourhood approach towards the energy transition	• Need for staffing by the municipality • Internal procedures can slow down needed fast response • Not all municipal neighbourhood activities join the initiative • Relatively high investment in staff and facilities	• Approach sustainability from multiple angles using events • Develop a neighbourhood anchor and local network • Activate local "ambassadors" • Toolkits for specific customer segments • Long term presence can lead to building networks and activating citizens • Different organisations might integrate their actions and customer relationship management to provide a smoother customer journey	• Lack of integrated follow-up of visitors • Neighbourhood includes homeowners with limited financial means • Proposed and executed measures are often "quick wins", e.g., installing led bulbs, airtightness strips, and so on
H	• Low running cost	• No cocreation	• Combined activities by advertising in local press, on website and social media	

References

1. European Commission. 2030 Climate & Energy Framework. Available online: https://ec.europa.eu/clima/policies/strategies/2030_en (accessed on 8 July 2021).
2. Risholt, B.; Berker, T. Success for energy efficient renovation of dwellings—Learning from private homeowners. *Energy Policy* **2013**, *61*, 1022–1030. [CrossRef]
3. Toleikyte, A.; Kranzl, L.; Müller, A.J.E.P. Cost curves of energy efficiency investments in buildings–Methodologies and a case study of Lithuania. *Energy Policy* **2018**, *115*, 148–157. [CrossRef]
4. Amoruso, G.; Donevska, N.; Skomedal, G.J.E.E. German and Norwegian policy approach to residential buildings' energy efficiency—A comparative assessment. *Energy Effic.* **2018**, *11*, 1375–1395. [CrossRef]

5. Gram-Hanssen, K.; Jensen, J.O.; Friis, F.J.E.E. Local strategies to promote energy retrofitting of single-family houses. *Energy Effic.* **2018**, *11*, 1955. [CrossRef]
6. European Commission. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and Committee of the Regions*; European Commission: Brussels, Belgium, 2020.
7. European Commission. *Report from the Commission to the European Parliament and the Council on the Assessment of the Risk of Money Laundering and Terrorist Financing Affecting the Internal Market and Relating to Cross-Border Activities*; European Commission: Brussels, Belgium, 2019.
8. Pardalis, G.; Mahapatra, K.; Mainali, B. A triple-layered one-stop-shop business model canvas for sustainable house renovations. In Proceedings of the IOP Conference Series: Earth and Environmental Science, Gothenburg, Sweden, 2–4 November 2020; IOP Publishing: Bristol, UK, 2020; p. 022060.
9. Wilson, C.; Crane, L.; Chryssochoidis, G. Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy. *Energy Res. Soc. Sci.* **2015**, *7*, 12–22. [CrossRef]
10. Bobrova, Y.; Papachristos, G.; Chiu, L.F.J.E.P. Homeowner low carbon retrofits: Implications for future UK policy. *Energy Policy* **2021**, *155*, 112344. [CrossRef]
11. Azizi, S.; Nair, G.; Olofsson, T.J.E. Adoption of Energy efficiency measures in renovation of single-family houses: A Comparative approach. *Energies* **2020**, *13*, 6042. [CrossRef]
12. Tsemekidi Tzeiranaki, S.; Bertoldi, P.; Diluiso, F.; Castellazzi, L.; Economidou, M.; Labanca, N.; Ribeiro Serrenho, T.; Zangheri, P.J.E. Analysis of the EU residential energy consumption: Trends and determinants. *Energies* **2019**, *12*, 1065. [CrossRef]
13. Pettifor, H.; Wilson, C.; Chryssochoidis, G.J.E.P. The appeal of the green deal: Empirical evidence for the influence of energy efficiency policy on renovating homeowners. *Energy Policy* **2015**, *79*, 161–176. [CrossRef]
14. Li, Y.; Kubicki, S.; Guerriero, A.; Rezgui, Y.J.R.; Reviews, S.E. Review of building energy performance certification schemes towards future improvement. *Renew. Sustain. Energy Rev.* **2019**, *113*, 109244. [CrossRef]
15. Wilson, C.; Chrysochoidis, G.; Pettifor, H. *Understanding Homeowners' Renovation Decisions: Findings of the Verd Project*; UK Energy Research Centre (UKERC): London, UK, 2013.
16. Bertoldi, P.; Economidou, M.; Palermo, V.; Boza-Kiss, B.; Todeschi, V. Environment. How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. *Wiley Interdiscip. Rev. Energy Environ.* **2021**, *10*, e384. [CrossRef]
17. Meijer, F.; Straub, A.; Mlecnik, E.J.S. Consultancy centres and pop-ups as local authority policy instruments to stimulate adoption of energy efficiency by homeowners. *Sustainability* **2018**, *10*, 2734. [CrossRef]
18. Baek, C.; Park, S. Policy measures to overcome barriers to energy renovation of existing buildings. *Renew. Sustain. Energy Rev.* **2012**, *16*, 3939–3947. [CrossRef]
19. Streimikiene, D.; Balezentis, T.; Alebaite, I.J.E. Climate change mitigation in households between market failures and psychological barriers. *Energies* **2020**, *13*, 2797. [CrossRef]
20. Hoff, J.; Gausset, Q. *Community Governance and Citizen-Driven Initiatives in Climate Change Mitigation*; Routledge: London, UK, 2015.
21. Bertone, E.; Sahin, O.; Stewart, R.A.; Zou, P.X.; Alam, M.; Hampson, K.; Blair, E.J.A.E. Role of financial mechanisms for accelerating the rate of water and energy efficiency retrofits in Australian public buildings: Hybrid bayesian network and system dynamics modelling approach. *Appl. Energy* **2018**, *210*, 409–419. [CrossRef]
22. Keirstead, J.; Schulz, N.B. London and beyond: Taking a closer look at urban energy policy. *Energy Policy* **2010**, *38*, 4870–4879. [CrossRef]
23. Hernandez, Y.; Rivas, S.; Barbosa, P. *Covenant of Mayors: Key Criteria for Adaptation to Climate Change in Local Plans*; European Union: Luxembroug, 2017.
24. Hoppe, T.; Miedema, M.J.S. A governance approach to regional energy transition: Meaning, conceptualization and practice. *Sustainability* **2020**, *12*, 915. [CrossRef]
25. Mahapatra, K.; Nair, G.; Gustavsson, L. Energy advice service as perceived by Swedish homeowners. *Int. J. Consum. Stud.* **2011**, *35*, 104–111. [CrossRef]
26. Tingey, M.; Webb, J.; van der Horst, D. Housing retrofit: Six types of local authority energy service models. *Build. Cities* **2021**, *2*, 518–532. [CrossRef]
27. Kwon, M.; Mlecnik, E.J.E. Modular Web portal approach for stimulating home renovation: Lessons from Local authority developments. *Energies* **2021**, *14*, 1270. [CrossRef]
28. Kivimaa, P.; Martiskainen, M. Innovation, low energy buildings and intermediaries in Europe: Systematic case study review. *Energy Effic.* **2018**, *11*, 31–51. [CrossRef]
29. Surchi, M. The temporary store: A new marketing tool for fashion brands. *J. Fash. Mark. Manag. Int. J.* **2011**, *15*, 257–270. [CrossRef]
30. Higginbottom, G.; Liamputtong, P. *Participatory Qualitative Research Methodologies in Health*; Sage: Thousand Oaks, CA, USA, 2015.
31. Cargo, M.; Mercer, S.L. The value and challenges of participatory research: Strengthening its practice. *Annu. Rev. Public Health* **2008**, *29*, 325–350. [CrossRef] [PubMed]
32. Richards, L.; Kennedy, P.H.; Krulewitch, C.J.; Wingrove, B.; Katz, K.; Wesley, B.; Feinson, C.; Herman, A. Achieving success in poor urban minority community-based research: Strategies for implementing community-based research within an urban minority population. *Health Promot. Pract.* **2002**, *3*, 410–420. [CrossRef]

33. Joyce, A.; Paquin, R.L. The triple layered business model canvas: A tool to design more sustainable business models. *J. Clean. Prod.* **2016**, *135*, 1474–1486. [CrossRef]
34. Mahapatra, K.; Gustavsson, L.; Haavik, T.; Aabrekk, S.; Svendsen, S.; Vanhoutteghem, L.; Paiho, S.; Ala-Juusela, M. Business models for full service energy renovation of single-family houses in Nordic countries. *Appl. Energy* **2013**, *112*, 1558–1565. [CrossRef]
35. Mlecnik, E.; Straub, A.; Haavik, T. Collaborative business model development for home energy renovations. *Energy Effic.* **2019**, *12*, 123–138. [CrossRef]
36. Osterwalder, A.; Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*; Wiley: Hoboken, NJ, USA, 2010.
37. Giourka, P.; Sanders, M.W.; Angelakoglou, K.; Pramangioulis, D.; Nikolopoulos, N.; Rakopoulos, D.; Tryferidis, A.; Tzovaras, D.J.E. The smart city business model canvas—A smart city business modeling framework and practical tool. *Energies* **2019**, *12*, 4798. [CrossRef]
38. Baumann, H.; Boons, F.; Bragd, A. Mapping the green product development field: Engineering, policy and business perspectives. *J. Clean. Prod.* **2002**, *10*, 409–425. [CrossRef]
39. Díaz-Díaz, R.; Muñoz, L.; Pérez-González, D.J.E. The business model evaluation tool for smart cities: Application to SmartSantander use cases. *Energies* **2017**, *10*, 262. [CrossRef]
40. Nurmuliani, N.; Zowghi, D.; Williams, S.P. Using card sorting technique to classify requirements change. In Proceedings of the Proceedings. 12th IEEE International Requirements Engineering Conference, Kyoto, Japan, 10 September 2004; pp. 240–248.
41. Massa, L.; Tucci, C.L.; Afuah, A. A critical assessment of business model research. *Acad. Manag. Ann.* **2017**, *11*, 73–104. [CrossRef]
42. Sanderse, J.; de Langen, F.; Salgado, F.P. Proposing a business model framework for nonprofit organizations. *J. Appl. Econ. Bus. Res.* **2020**, *10*, 40–53.
43. Hvenmark, J. Business as usual? On managerialization and the adoption of the balanced scorecard in a democratically governed civil society organization. *Adm. Theory Prax.* **2013**, *35*, 223–247.
44. Ziegler, W.; D'ippolito, R.; D'Auria, M.; Berends, J.; Nelissen, M.; Diaz, R. Implementing a "one-stop-shop" providing smes with integrated hpc simulation resources using fortissimo resources. In Proceedings of the eChallenges e-2014 Conference Proceedings, Belfast, UK, 29–30 October 2014; pp. 1–11.
45. Ojasalo, J.; Ojasalo, K. Service logic business model canvas. *J. Res. Mark. Entrep.* **2018**, *20*, 70–98. [CrossRef]
46. Weerawardena, J.; McDonald, R.E.; Mort, G.S. Sustainability of nonprofit organizations: An empirical investigation. *J. World Bus.* **2010**, *45*, 346–356. [CrossRef]
47. Glenn, T. *Professional Communications in the Public Sector: A Practical Guide*; Canadian Scholars' Press: Toronto, ON, Canada, 2014.
48. Barry, B.; Fulmer, I.S. The medium and the message: The adaptive use of communication media in dyadic influence. *Acad. Manag. Rev.* **2004**, *29*, 272–292. [CrossRef]
49. Howlett, M. Government communication as a policy tool: A framework for analysis. *Can. Political Sci. Rev.* **2009**, *3*, 23–37.
50. Thomas, J.C. Citizen, customer, partner: Rethinking the place of the public in public management. *Public Adm. Rev.* **2013**, *73*, 786–796. [CrossRef]

sustainability

MDPI

Article

Behind the Targets? The Case for Coherence in a Multi-Scalar Approach to Carbon Action Plans in the Transport Sector

Greg Marsden * and Jillian Anable

Institute for Transport Studies, University of Leeds, Leeds LS2 9JT, UK; J.L.Anable@leeds.ac.uk
* Correspondence: tragrm@leeds.ac.uk; Tel.: +44-(0)113-3435358

Abstract: The Paris Agreement requires radical action across all policy sectors and at all scales of government. This paper argues that without a clear framework for sectoral budget setting which takes account of interactions across spatial scales, incoherent and inadequate policy responses will result. Using a case study of the transport sector within the UK, which has committed to a zero carbon pathway in law, we look at three key elements which have to be considered in setting out a new framework: budget coherence, accounting coherence and policy coherence. Using top-down and bottom-up examples emerging from practices today in the UK, we demonstrate that there are no 'optimal' solutions but a set of choices, all of which appear to be better than the patchwork of approaches emerging in the absence of a framework. A multi-scalar approach is essential as transport crosses spatial boundaries and the policy system places different levers at different scales. Transparency will be beneficial for honesty with the public and the difficult politics this rapid transition necessitates. It will also mitigate against blame shifting across governments between and within scales and the resultant inaction which characterized the previous decade of supposed 'climate action'.

Keywords: Paris Agreement; carbon budgets; transport; governance; carbon accounting; climate change; scalar; top-down; bottom-up

Citation: Marsden, G.; Anable, J. Behind the Targets? The Case for Coherence in a Multi-Scalar Approach to Carbon Action Plans in the Transport Sector. *Sustainability* **2021**, *13*, 7122. https://doi.org/10.3390/su13137122

Academic Editors: David Tyfield, Rebecca Willis and Andy Yuille

Received: 26 March 2021
Accepted: 11 June 2021
Published: 25 June 2021

1. Introduction

The past three decades have seen increasing political recognition of the need to reduce global cumulative carbon emissions and a science-led ratcheting up of the stringency of carbon budgets which are consistent with limiting global warming [1,2]. This has also been a period in which the pace of action has yet to match the political commitments to act [3,4]. To meet the challenge of the climate crisis requires rapid and difficult actions across all scales of government. To date, a reluctance to break commitments down by sector or spatial scale has resulted in a patchwork framework which enables blame shifting and incrementalism [5,6]. In this paper, we look at three key elements which have to be considered in setting out a new framework: budget coherence, accounting coherence and policy coherence. Using top-down and bottom-up examples emerging from practices today in the UK, we demonstrate that there are no 'optimal' solutions due to the multi-scalar nature of the problem and the mismatch of policy competencies to the spatial governance scale. This paper concludes that coordination across scales can be facilitated through addressing the three components of coherence, and without this, the difficult political decisions that the climate crisis demands are more likely to remain unresolved.

The accounting and accountability frameworks set up by the United Nations Framework Convention on Climate Change (UNFCCC) are all based around national territorial responsibilities. The 2015 Paris Agreement commits "to holding the global increase in global average temperatures to well below 2 °C" and to seeking to limit the rise to 1.5 °C [7]. The science underpinning what comprises a safe budget is continuously evolving [2]. For any given budget, however, the process of allocating responsibility for the global carbon

budget to the different national territories has long been identified as being "as much a political as a scientific issue" [8]. Such concerns also matter within national territories, and this is the focus of this paper.

This paper is based on an analysis of the United Kingdom (UK). The UK government has set a UK-wide target under the Climate Change Act 2008 and Climate Change Act 2008 (2050 Target Amendment). The latest amendment, ratified in 2019, adds a commitment to cutting emissions by 100% by 2050 (from 1990 levels), with a series of five-year budget periods set along the route. Previous research has shown that the presence of ambitious targets (80% reductions at that time) served as a 'lodestar' to point actors in a new direction but offered little in the way of structure to stimulate change [9]. However, a 100% reduction goal should change the nature of the debate from what is to be included in the emissions reduction goals to 'by when?' and 'how?' as all sectors are, de facto, critical. The policy position has now effectively moved beyond arguments about whether sectoral target setting is a good idea [10,11].

The UNFCCC process is a top-down territorial allocation process, and in the UK, the government has refused to consider allocating responsibilities to jurisdictions below that of the devolved nations (Scotland, Wales and Northern Ireland). In parallel with and in contrast to the top-down UNFCCC process, there is a vibrant local response to the climate crisis at a local scale, with climate emergencies declared in an estimated 1910 jurisdictions and local governments across the world (which, combined, would represent over 826 million citizens) [12]. This is true too in the UK, with 74% of local authorities estimated to have declared climate emergencies by February 2021 [13]. Local action and political engagement must be part of any rapid transition [14]. The key point here is that there is a multi-scalar response to the climate crisis unfolding in a way which is not being coordinated.

This paper uses the transport sector to demonstrate why this lack of coordination matters and how the concerns which exist at an international scale about how to assign budgets and responsibility also play out strongly in subnational policy systems. The transport sector is selected, as it is both the largest contributor to climate emissions [15] in the UK and also one which evidently crosses different scalar governance boundaries. To illustrate the nature of the coordination challenge, a sample of 183 (of the 300) climate emergencies declared in the UK in October 2020 were reviewed, which revealed the following:

- Only 38% of authorities had declared an emergency with no target or pathway;
- Only 15% of authorities were in the process of setting targets;
- Only 47% of authorities had set a target. However, of these, 41% were for emissions only by the local authority's own activities, with 59% being area-wide targets;
- Only 8% set targets for the transport sector.

What lies behind this piecemeal approach is not clear. For some authorities, the race to declare the earliest date for zero emissions across local authorities has been likened to "exercises in vanity" with the targets helping "politicians to be seen to be doing something when actually they are not" [16] (p. 65). For others, undoubtedly there are still debates about what accounting method to use, what physical boundaries to use and what system boundaries are applied [17–19], which provide a shield for inaction. The lack of clear recognition of the need for multi-scalar allocation of emissions responsibilities is allowing an incoherent approach to unfold.

In this paper, we attempt to resolve the issue of how to achieve coherence across different spatial governance scales. The OECD identifies a key aspect of policy coherence as being the establishment of effective governance mechanisms "to address policy interactions . . . and align actions between levels of government" [20] (p. 4). In this paper, we expand the notion of coherence to three different aspects which we see as necessary for effective carbon governance:

1. Budget coherence: Are the budgets aligned across authorities and scales?
2. Accounting coherence: What gets counted where?
3. Policy coherence: How are budgets aligned with the capacity to act?

We demonstrate that the components of coherence do not all align in some optimal solution. Where budget coherence is at its greatest does not map well to where policy coherence is at its greatest. We know that the current institutional structures are undoubtedly not well matched to tackling wicked problems such as climate change [21]. However, institutional structures are also quite rigid, and policy siloes are difficult to change [22,23], so urgent action can only be enacted through the institutions we have. Even if governance reform were on the table, there would be tensions between the categories of coherence under any configuration. We argue then for a pragmatic approach to enable recognition of the importance of finding a multi-scalar solution and to choosing a way forward.

This paper proceeds as follows. First, we set out the data sources and methods we use to support the analysis, which we use to resolve our arguments on coherence in Section 2. In Section 3, we look at the international to national translation of what the Paris Agreement means for a country such as the UK and then what the UK Climate Change Committee has assessed this to mean for emission reduction targets in transport. Section 4 then shifts to a consideration of a spatial scale through consideration of carbon accounting approaches and by mapping the governance realities to the task of carbon reduction. The concluding section draws together the different components of our arguments. It demonstrates that enough is known to agree on a meaningful accounting and accountability framework across scales.

2. Materials and Methods

This article uses secondary data sources to inform its arguments. The data sources are all publicly available and introduced here with an explanation of how they have been applied. In addition, the ranking analysis which is conducted to explore accounting coherence in Section 4.2.2 is explained.

In Section 3, the article uses data from the Climate Change Committee's Sixth Carbon Budget [24]. The data are all made freely available on the Climate Change Committee website [25]. This allows for the annual disaggregation of total mitigation and residual emissions by sector, which is reported in Section 3. Aggregate charts which are used in the Sixth Carbon Budget report are also accessed from this site.

In Section 4.2.1 on budget coherence, two local climate action plans are used to explore consistency across overlapping spatial scales [26,27]. The data used in the analysis are extracted from publicly available reports, but the elaboration of the Leeds and West Yorkshire pathways is the authors' own based on stated annual emission reduction rates and the local climate action plan's projections. Both plans were, at the time of writing, subject to either consultation or further work to identify a preferred final pathway.

Section 4.2.2 examines accountability coherence at different spatial scales. Two data sets were used to inform this analysis. The territorial emissions estimates were derived from the UK National Atmospheric Emissions Inventory, published by the Department of Business, Energy and Industrial Strategy, which reports on territorial emissions using, for road transport, traffic flow estimates and speed-flow curves to allocate emissions according to where they take place [28]. Only road transport emissions were used, which represented 96% of the categorized emissions. For a production-based approach (as per Harris et al. [18]), we used data provided by Transport for the North, which provides estimates of emissions for residents of different areas on the basis of car ownership, vehicle type and annual mileage as recorded in the annual roadworthiness test and assigned by locality. This draws on the methodology of Wilson et al. [29]. The data are available at different local authority spatial scales and for both data sets for the period of 2010–2018 for England, Scotland and Wales but are not yet publicly available. This data set did not, however, include freight transport emissions.

As part of the accounting coherence assessment, the performance (overall CO_2 emissions from surface transport) was estimated for each local authority unit. There were 382 local authority units which could be considered at the smallest scale for the analysis. In order to understand the difference that exists between using territorial and production-

based estimates (and taking into account the issue of freight differences), we applied a ranking and rank change method. For each assessment, a rank was assigned, with one as the lowest carbon rating and n the highest carbon rating, where n is the number of authorities considered in the analysis. Rank change was calculated by taking the rank from the production estimate away from the rank of the territorial estimate. Rank changes of zero or close to zero would therefore be indicative of zero or small relative differences between methods.

3. Translating the Paris Agreement to the UK Transport Sector

As set out in the introduction, the Paris Agreement sets out a commitment to keep global temperature rises well below 2 °C, with an aim of limiting that to 1.5 °C. There are different approaches to allocating the limited carbon budget implied by the Paris Agreement across countries. Figure 1 sets out the budget proposed by the UK Climate Change Committee (hereafter CCC), which it deems to be Paris compliant [24]. The cumulative CO_2 emissions allowed by the CCC's 'balanced net zero pathway' amount to 6975 MtC between 2020 and 2050. This allows for 1493 MtC of negative emissions through removals from carbon capture and storage and land use changes such as afforestation [24]. Despite the predominant position of the CCC in the UK climate policy picture, there are alternative and more aggressive budgetary approaches in use in the UK which are less reliant on negative emission technologies [2]. The implications of the divergence in approaches to budget setting will be discussed further within our case studies in Section 4.2.1.

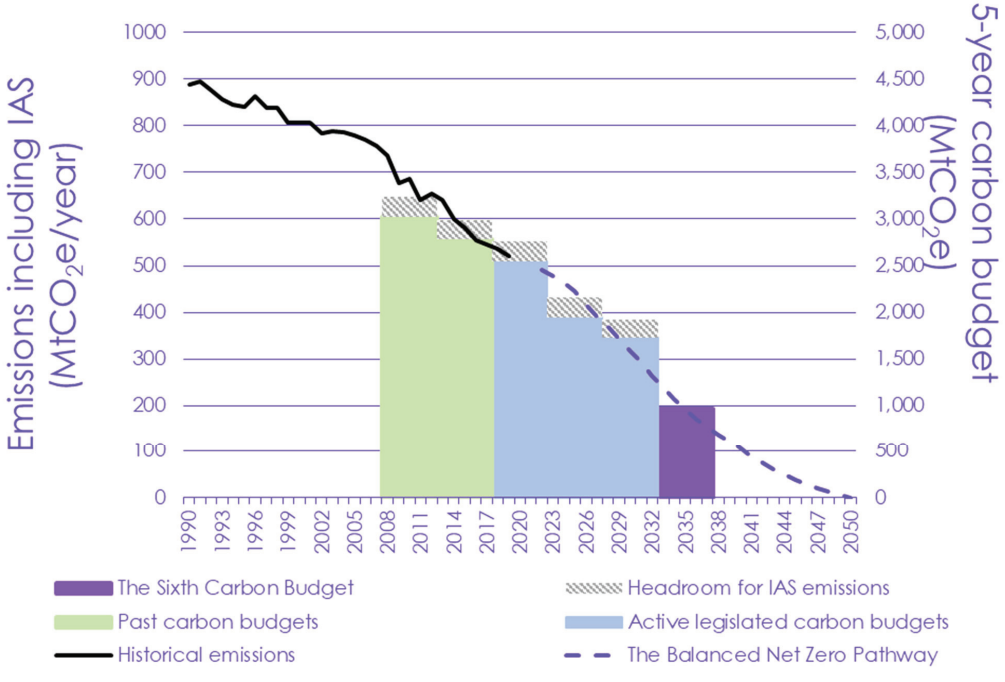


Figure 1. Carbon budgets set out by the Climate Change Committee [24].

Globally, the transport sector comprises 24% of direct CO_2 emissions from fuel combustion, and this has risen at a rate of 1.9% per annum since the year 2000 [30]. In the UK in 2019, transport comprised 27% of CO_2 emissions (excluding international aviation and shipping) and, at 119.6 MtC, was only 4.6% lower than nearly 30 years ago in the baseline

year of 1990 [15]. Transport's importance to the overall emissions burden and trajectory are now so significant it can no longer lag behind the national trajectory.

Turning now to the interpretation of the Paris Agreement for the transport sector, the CCC budget assessed that surface transport will need to reach absolute zero (i.e., to not rely on any negative emission technologies) by 2050. Its indicative budget is 1588 MtC (23% of the overall budget) over the period, with an annual percentage decline of 4% every year from 2020 to a residual emission of 1 MtC per annum in 2049. By 2035, annual surface transport emissions should be 72% lower than 2019 levels which, by that time, exceeds the economy-wide average (65%). Figure 2 shows the indicative reduction pathway which the CCC sees to be consistent with the agreed budget. Figure 3 shows the breakdown of transport emissions to date and shows how emissions have reduced by just 4.6% in 30 years. Surface transport needs to transition to being a leading rather than lagging sector.

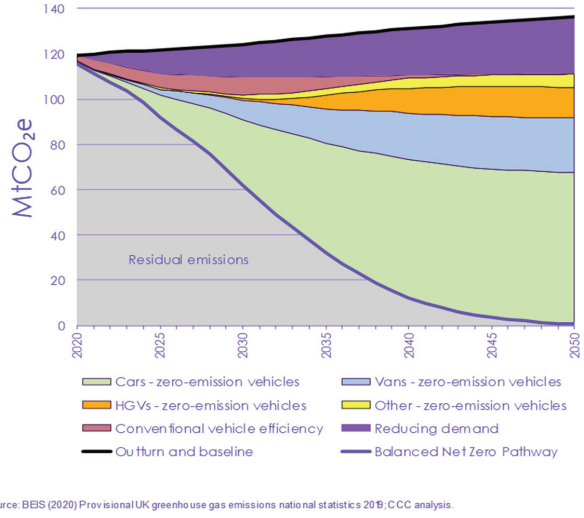


Figure 2. Estimates of sources of abatement from the balanced net zero pathway from the Sixth Carbon Budget [24].

The CCC pathway requires a mix of demand reduction (mainly mode shift), electric vehicle uptake in the private car market and then, over time, decarbonization of heavy goods vehicles. Table 1 translates Figure 2 into five-year budget periods to give a more transparent understanding of the contribution of different policies relative to the baseline. Only 12% of the total abatement from surface transport is expected in the first decade to 2030, which seems very slow given the overall importance of transport to total carbon emissions. In the first five years to 2025, demand reduction is the largest contributor, with 36.3% of the abatement in the period and remaining the second most important category over the period to 2050 at just under one fifth of all emission reductions. This is due to a mixture of mode shift and virtual travel substitution. Electrification of the car market grows in importance, forming 26.6% of emission abatement to 2025 and then becoming the largest category thereafter, totaling just under half of all abatement. Over the period to 2050, the total car distance is on track to stay at approximately 2020 levels once underlying growth and rebound effects from lower electrified motoring costs are taken into account.

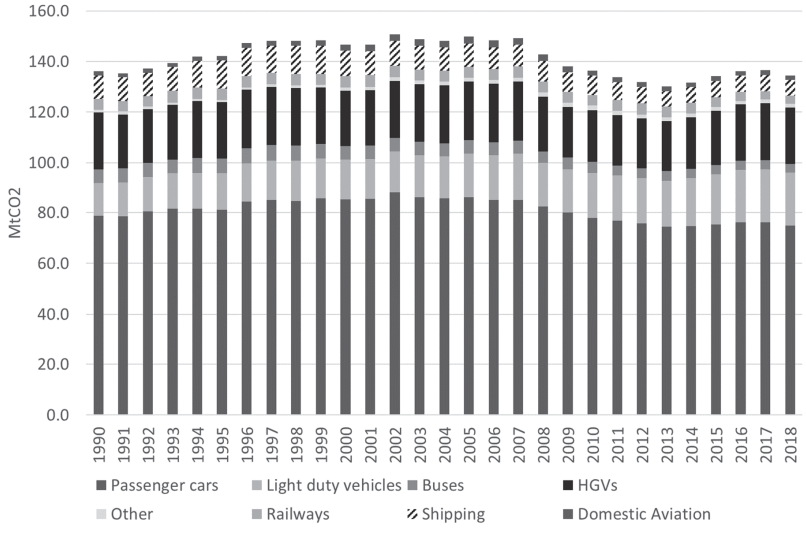


Figure 3. Change in transport sector CO_2 emissions from 1990 to 2018 (source: [15]).

Table 1. Estimates of sources of abatement by five-year period $MtCO_2$ and percentage (in brackets) (source: [25]).

Abatement Source	2021–2025	2026–2030	2031–2035	2036–2040	2041–2045	2045–2050	Overall 2021–2050
Demand Reduction	33 (36.3)	65 (26.8)	82 (19.9)	97 (17.6)	110 (17.3)	121 (18.1)	509 (19.5)
Electrification Cars	24 (26.6)	104 (43.0)	205 (49.6)	284 (51.4)	322 (50.8)	332 (49.6)	1271 (48.9)
Efficiency Existing fleet	26 (28.8)	36 (14.8)	34 (8.1)	14 (2.6)	4 (0.7)	2 (0.3)	116 (4.5)
Electrification Light Vans	6 (6.9)	30 (12.4)	63 (15.3)	93 (16.8)	112 (17.6)	119 (17.8)	423 (16.3)
Heavy Goods + Other	1 (1.1)	7 (2.9)	29 (7.0)	64 (11.7)	86 (13.6)	95 (14.2)	283 (10.9)
Total Cumulative Abatement in Each Period ($MtCO_2$)	**92**	**242**	**414**	**552**	**633**	**670**	**2602**

Brand et al. describe the application of the UK TEAM model to assess different technology and behavior change pathways to 2050 in line with the Paris Agreement [31]. Their paper focused on the implications of different phase out dates and options for vehicle technology, with the UK government recently announcing that it would phase out the sale of ICEs and hybrid vehicles in 2030 but allow the sale of plug-in hybrid vehicles through 2035 [32]. The analysis found that no 'technology only' scenario was compliant with their interpretation of the Paris budget. The technology pathway selected by the UK government could just meet the Paris cumulative budget with a major package of behavior change (a 'lifestyle' scenario). Such changes would include "overall passenger travel demand decreases [of] 2% by 2030 and 12% by 2050. The distance traveled by car as a driver or passenger per head of population decreases 20% by 2030 and 51% by 2050, with increases in bus travel (172% for urban bus, express coach and rural mini bus services combined)" with cycling and walking also increasing [31] (p. 4). Cycling increases from 1% of distance traveled to 8% by 2050, mostly replacing car journeys of under 5 miles in length. While there are many other studies which point to the importance of a balance

of measures to reduce travel demand, to shift more travel away from the private car and to achieve full decarbonization of the fleet over time [33,34], few take an explicit carbon budget constraint approach.

While top-down modeling approaches very clearly point to the importance of actions being taken at a range of spatial scales, the balance between national, regional and local levels and between emission reduction technologies and demand shifts is contested. Creutzig suggests that top-down modeling approaches typically marginalize the role of local actors and that 20–50% of carbon emission reductions could be achieved through more local actions around planning and behavioral change [35]. Others present coherent arguments as to why local actions should be important without quantifying the likely impacts [33,36,37]. To date, despite the theoretical case for the importance of local actions, the evidence on the additional value of local action has been mixed [38,39].

The analysis above points to the importance of transport as a sector to the overall emissions reduction trajectory and the need to lead rather than lag behind any nationally defined budget constraint. The scale of emission reductions required and the need for early action mean that there is a requirement for action across a range of scales. Even for matters such as electrification, which will be heavily influenced by the national fiscal and regulatory framework, there are key local actions. Similarly, behavior change initiatives will often be led locally but are conducted within the national framework of subsidy, fuel taxes and regulation, which define the relative costs of different modes of transport. The climate problem in the transport sector is multi-scalar in nature, as is the policy environment through which any transition will be delivered. We now turn to exploring more about differences across scales and what could be done to develop a more coherent multi-scalar approach.

4. Translating National Sectoral Targets to Subnational Scales

As we introduced in Section 1, 74% of local authorities have declared climate emergencies but have taken an extremely inconsistent approach to what this really means. Setting carbon commitments at a subnational scale has a range of technical challenges [17–19]. However, the arguments that it is difficult to decide how to do this or that it may lead to suboptimal outcomes have been overtaken by events. An inconsistent approach has emerged in the vacuum created by the decision not to cascade the carbon budgets.

In this section, we review the arguments for subnational intervention in this space and underline the potential benefits of providing greater structure to this process. To begin, it is important to understand something of the complexity of subnational governance in the UK.

4.1. Subnational Government in the UK

The structure of local government across the UK is complex and different across the four administrations [40]. England has the largest population and the most complex arrangements comprising up to four tiers, although this can vary from two (national and local) to four. This provides a context where many nested boundaries need to be considered for carbon accounting. The five broad categories are as follows:

- National government (UK, Scotland, Wales and Northern Ireland), which has a mix of competencies on tax and fiscal policy which applies across the four nations (including England) but where transport and planning policies are largely managed separately [41].
- Sub-National Transport Bodies, as regional governance in the UK has had a mixed history [42], with regional planning being a feature of the early 2000s but abolished in England and Wales by 2010, for example. In 2019, Transport for the North was established as the first statutory Sub-National Transport Body, covering 20 local authorities in the North of England to conduct strategic planning for, among other elements, new infrastructure. While not originally conceived with a carbon management role, this is currently being developed [43]. Other non-statutory subnational transport bodies exist.

- Combined authorities represent clusters of local authorities that have formal governance structures to work together, based initially around the logic of shared travel to work areas which defined the metropolitan counties up to their abolishment in the 1980s. Other forms of combined authority are now being set up, and many also now have elected mayors, who are delegated some powers [44].
- Shire counties are typically larger rural counties which are comprised of district authorities. Most of the transport planning powers sit with the shires.
- Unitary authorities are typically, but not exclusively, smaller cities which do not neatly fit within shire boundaries or which have been separated out in local government reorganizations. Combined authorities are made up of an aggregation of unitary authorities.

Vagnoni and Morati suggest that "local government is an important level of government as it is the closest public organization to the citizens; local government is in a unique position to understand, inform, guide and lead local inhabitants, businesses and industries" [37] (p. 489). Willis suggests that the connection to politics and democracy needs to be brought to the fore, given the nature of the radical transition that is faced [30]. Indeed, climate emergencies have been declared by every tier, with the exception of Sub-National Transport Bodies. However, subnational action raises some quite challenging questions for the coherence of carbon governance [19,38] which we turn to next.

4.2. Coherence in Carbon Management for Transport

The OECD definition of policy coherence introduced in Section 1 pointed to the need for effective governance mechanisms focused on policy interactions which aligned actions between levels of government. We have interpreted this to cover three key dimensions of coherence, which we relate to the definition and then explore more fully in turn:

1. Budget coherence concerns budgets as a mechanism through which the sum of the actions of different actors meet the national goals;
2. Accounting coherence is a means through which questions about what gets counted where are resolved to align actions between different levels of government;
3. Policy coherence considers the relationship between the budget and accounting coherence and the policy competencies to act at different spatial scales.

4.2.1. Budget Coherence

Within any given budget framing, a key aspect of a coherent budget is that the total change in any given period is made up of the sum of the parts. Whatever annual percentage reduction is set by the national trajectory must be met by the sum of the actions across all local areas. This would be true for each sector as well as across all sectors. Where authorities do not take action, there is an implicit correction assumption within the national framing that some other area will move faster to compensate. This is rarely stated.

As Anderson et al. set out, "long-term targets do not have a scientific basis and are leading to dangerously misguided policies. If a policy is to be scientifically credible, it must be informed by an understanding of cumulative emissions and associated emissions pathways." [8] (p. 3714). In looking across the 183 authorities that declared climate emergencies, only 27% set an area-wide commitment for emission reduction. Within this, very few agreed to an overall budget rather than picking an end date by which zero emissions would be achieved. The lack of national guidance on what process should be undertaken has, unsurprisingly, resulted in some very different practices that seem to be poorly aligned with the national goals.

The issues persist even when examining authorities which have moved early and been advised on science-based target setting. We illustrate this through a case study within West Yorkshire in the North of England where we contrast the largest city (Leeds) to the wider West Yorkshire Combined Authority area (see Table 2). Transport for the North, which sits across all of the authorities in the north, is developing its decarbonization strategy, with a plan to publish said strategy in 2021, and so it is following rather than leading in the process.

Table 2. Key comparator statistics for Leeds City Council and West Yorkshire Combined Authority.

Topic	Leeds City Council	West Yorkshire Combined Authority
Geography	Leeds City Council	Leeds City Council, Bradford Metropolitan District Council, Kirklees Council, Calderdale Council, Wakefield Council
Population	793,139	2,520,000
Area	552 sqkm	2029 sqkm
Declaration of Climate Emergency	27 March 2019	27 June 2019
Territorial Surface Transport Carbon Emissions 2018 (NAEI)	1659.5 MtC	4064.2 MtC
Date for Zero Transport Emissions	2030	2038
Budget Framing	Leeds Climate Commission and PCAN network	Tyndall Centre
Technical Reports	https://leedsclimate.org.uk/leeds-carbon-roadmap-2019 (accessed on 1 June 2021)	https://www.westyorks-ca.gov.uk/media/4268/emission-reduction-pathways-report.pdf (accessed on 1 June 2021)
Reductions in Car Demand	30%	21–38%
Increase in Bus Use	100%	39%
Increase in Cycling	400%	2000%

The trajectories set by Leeds City Council [26] and the West Yorkshire Combined Authority [27] are shown below in Figure 4. Some observations on coherence stand out. First, the WYCA adopted the Tyndall Centre approach to emissions reduction, which suggests a reduction of 14.1% per annum to be within the assigned budget. This is more ambitious than the CCC budget set out earlier but is science-led, with 2038 being set as an end date on the basis of the earliest reasonable projection for achieving zero emissions, allowing for negative emission technologies and forestation. The Leeds City Council used a different budgeting approach informed by climate scientists at Leeds University, but it set a target end date of 2030, which is more ambitious than the science-recommended approach. Even within bodies with overlapping administrative relationships, there are budgetary inconsistencies.

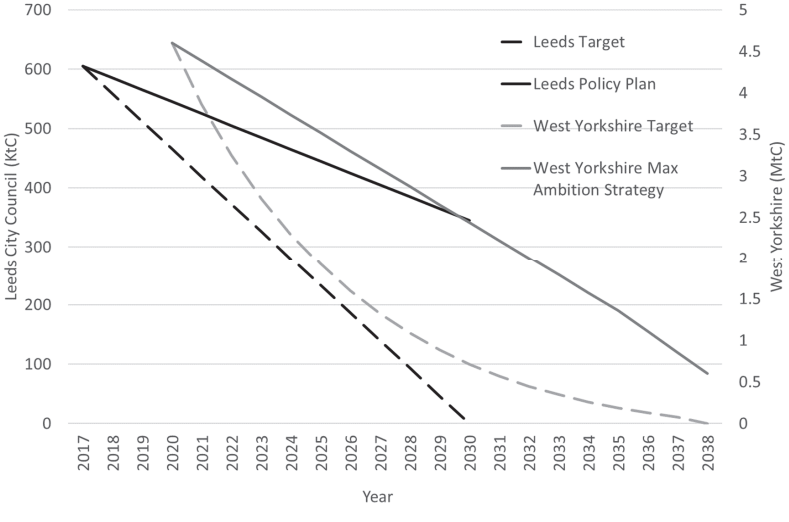


Figure 4. Subnational carbon budget and policy trajectories for the West Yorkshire Combined Authority and Leeds City Council.

Leeds City Council is currently consulting on a strategy that would get it to a 43% reduction by 2030, leaving a 57% gap. The WYCA has mapped out some possible emission reduction pathways without adopting, as yet, a preferred policy position or identifying the gap against the implied trajectory. The maximum ambition scenario is shown on the chart, again falling well outside of the annual reductions implied by the Tyndall Centre, which steered the pathway approach. Even with startlingly high mode shift and car reduction aspirations, neither area has a plan yet which is consistent with the budget. We return to policy coherence in Section 4.2.3.

4.2.2. Accounting Coherence

Within the example just shown, we also see elements of the second aspect of interest: accounting coherence. Leeds represents 40% of West Yorkshire's emissions (on the basis of territorial emissions), yet the transport emissions which Leeds is identifying as its problem represent just 12% of the WYCA total in 2020, suggesting a narrowing of the focus to journeys with both origins and destinations within Leeds City Council only.

There are a number of different options that could be considered to address accounting coherence and how boundaries are drawn. Many reviews discuss the merits and disadvantages of the three main approaches [17,19,38,45]:

- A territorial-based emissions approach where the place in which the emissions occur is the basis for accounting. In transport, this means assigning the emissions to where the movement occurs as a proxy for where fossil fuels are used.
- A production-based approach where sources of production are assigned the emissions, no matter where the end consumption is. In transport, for example, this would assign emissions to residents of an area irrespective of how much of their emissions burden is within that area.
- A consumption-based approach, which assigns the emissions associated with the whole consumption chain (including imports) to the place where consumption occurs.

It is broadly agreed that consumption-based approaches indicate higher levels of emissions for cities than other approaches, as the use of territorial boundaries can outsource emissions to production elsewhere, and the choice of approach does matter (see [18] for a fuller discussion).

Hermannson and McIntyre looked at accounting at a core city, wider city region and national level in Scotland using an input–output model and concluded that issues of transboundary flows are just as important at the local and regional scales (due to commuting flows, retail and industrial movements) as they are nationally and that "it is important to understand the spatial interdependencies that exist in the composition of the emissions total within regions and nations" [46] (p. 1). Salon et al., specifically looking at transport, also found that "On road vehicles move freely between localities, emitting greenhouse gas emissions as they go. The best method of assigning these emissions to localities and measuring them is not immediately obvious but should be based upon some measurement of distance traveled (VKT) by vehicles in that region" [36] (p. 2036).

Figure 5 shows the distribution of trips by private car by journey length and their relative contribution to total mileage by the same journey length categories as captured by the National Travel Survey. While the fleet of electric vehicles in the UK remains small, this acts as a good proxy for tailpipe CO_2 emissions. The data shows that 96% of trips are under 35 miles in length and might, therefore, be well-suited to governance at a shire county or combined authority scale. However, this comprises just under two-thirds of the distance traveled and carbon consumed from passenger trips. Freight transport also operates over larger scales, and so transboundary flows beyond even a shire county or urban combined authority matter.

While the arguments for consumption-based accounting are strong, the lack of data and, importantly, lack of policy competences to act on imports and industrial policy below the national scale mean that, for now, we consider territorial or production-based approaches.

Figure 6 shows the distribution of emissions across the local authorities using both methods for all transport emissions (a and b) and then per capita (c and d). The difference in ranking when applying the two methodologies, as explained in Section 2, for total emissions is shown in Figure 6e. Then, the smallest units were aggregated so that counties were used rather than their constituent districts (Figure 6f) using the same rank difference approach. Then, metropolitan unitary authorities were aggregated to combined authorities (Figure 6g).

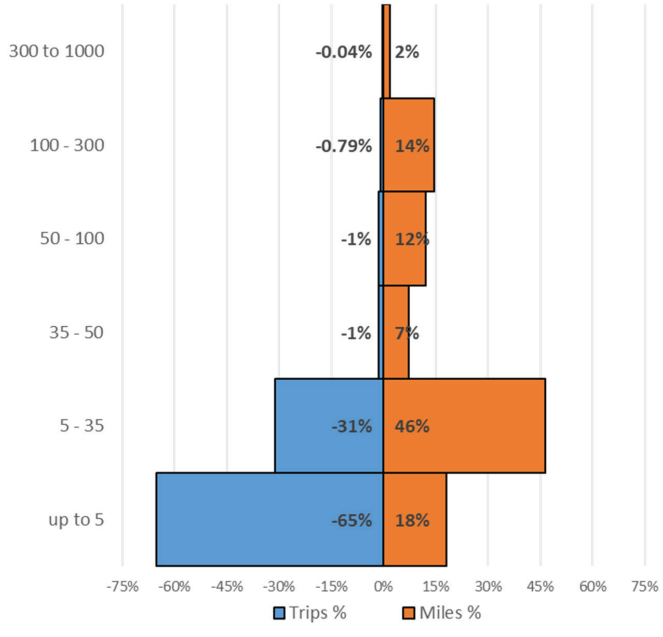


Figure 5. Trips and mileage by journey length band for cars. Source: National Travel Survey.

Both methodologies produced a very considerable spread of emissions performance at the most disaggregated spatial scale, although the distributions were highly skewed, with a larger concentration of lower bands. As the spatial scales of local government were aggregated, the differences between accounting methods diminished as expected because the larger scales of government would encompass more of the distance traveled and, therefore, the emissions (as per Figure 5). Large rank changes between the two methods are indicative of a mismatch between estimates, which were based on movement within an area and those which might be associated with residents of that area. At the lowest spatial scale (Figure 6e), we see a standard deviation of rank changes of 81; that is to say, a third of the authorities changed ranks by more than 81. As we move up the aggregation level, we see the rank shifting reduce considerably (Table 3). We accounted for the reduction in numbers of authorities considered at different levels of aggregation by using the standard error as our comparator.

Table 3. Comparison of rank changes by spatial aggregation.

Aggregation	N	Standard Deviation	Std Error
Districts (e)	367	81.1	4.35
Counties (f)	168	20.8	1.60
Combined Authorities (g)	105	10.7	1.04

There still remained a considerable spread at the county scale, with a third of the authorities moving more than 20 places, but there was a very clear reduction in difference between methods as one moved to aggregation at both the county and combined authority scales. This suggests that arguments about how to account for emissions diminish with spatial aggregation, in line with expectations.

4.2.3. Policy Coherence

The implications of accounting at different scales need also to be set against the competencies to act at the different scales. This is the third of our areas of exploration: policy coherence. In Table 4, we set out some of the key powers at different spatial scales to intervene in the transport sector. These are split across different scales, with the primary actors being national and county or unitary authorities, although every layer has a role, and the actual balance plays out differently in different parts of the country.

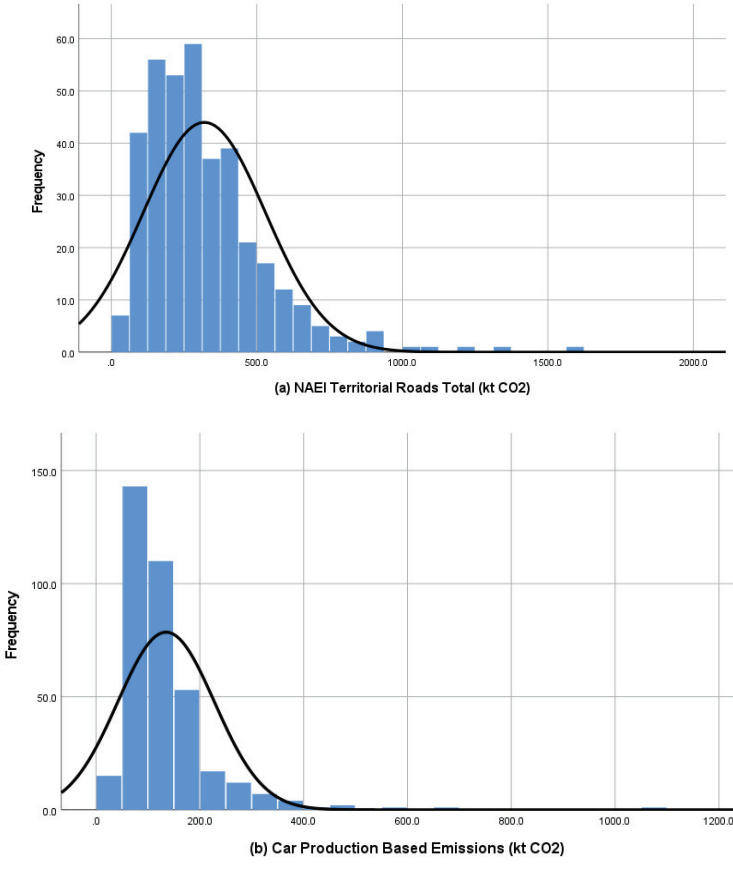
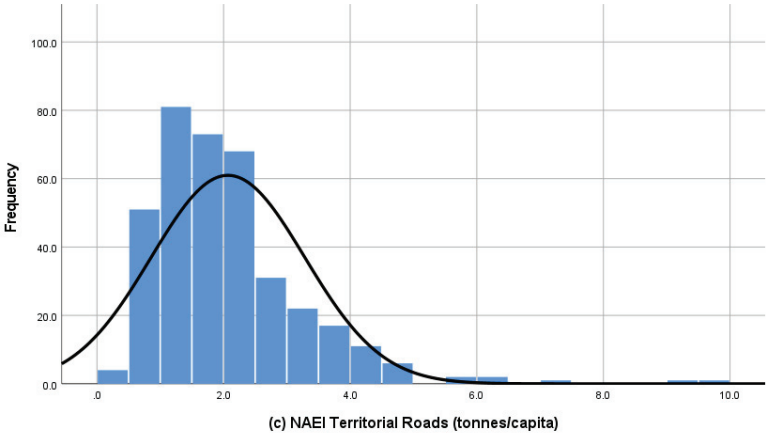
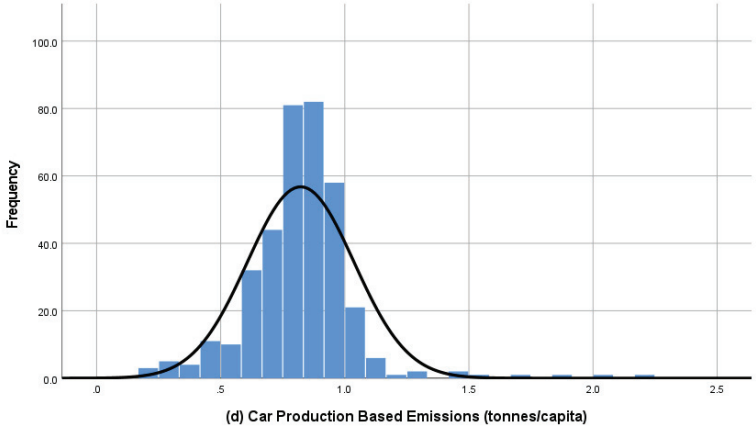


Figure 6. *Cont.*





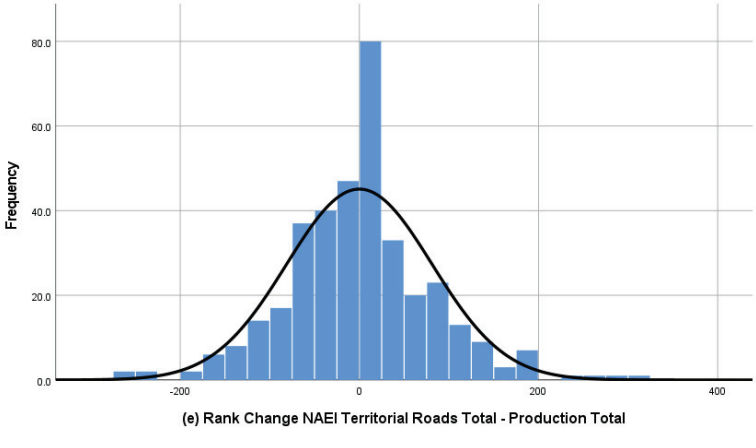


Figure 6. *Cont.*

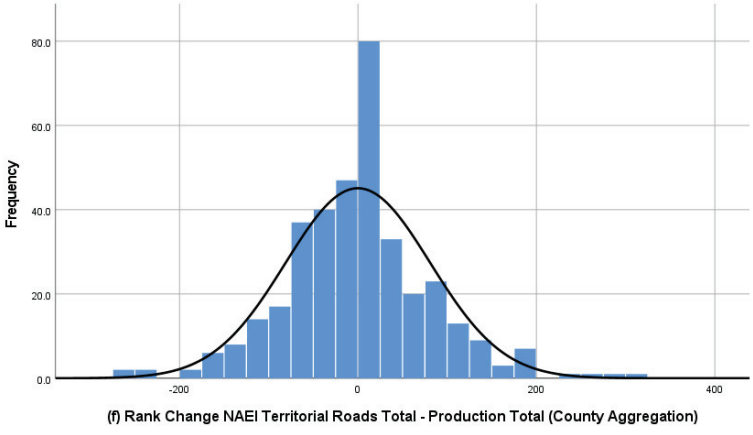


Figure 6. Territorial and production-based emission estimates and the differences in ranking by method at different levels of spatial aggregation. Subscripts (**a**–**g**) represent different levels of aggregation.

We can see from Section 4.2.2 that the accounting coherence increases as we move up spatial scales from local to subnational (and then national as the final scale of aggregation). By contrast, the policy competencies have more of a dumbbell shape, with lots of competencies held at a national level and county or unitary level but far fewer in between. While in some places mayoral combined authorities are beginning to acquire more powers and some financial autonomy, the metropolitan district councils which form the combined authority areas still wield a lot of power [44]. There is no obvious 'optimal' approach which matches accounting coherence and policy coherence due to the messy cross-boundary nature of transport flows (Section 4.2.2), and the historic distribution of policy competencies, which developed largely before climate change, was a recognized policy problem.

Table 4. Indicative powers to act on decarbonization in England (authors' elaboration).

Layer	Fiscal	Regulatory	Infrastructural	P.T. Services	Planning
National	Fuel Duty Vehicle Excise Duty Company Car Tax	Emission Standards, Charge Point Obligations, Highways England and Network Rail Regulatory Framework	Roads and Rail Investment Strategies Cycling Infrastructure Funding (LCWIP) Major Schemes and City Deals	Funding Framework and Subsidy: evels Regulatory Conditions Green Purchase Subsidy	Planning Policy Framework Housing Targets and Housing Delivery Grants
Sub-national			Strategic and Business Case Development	Lobbying and Ticketing Coordination	
Combined authority			Strategic and Business Case Development and Delivery	Bus Franchising Managing Socially Necessary Services Operating Tram Systems Integrating Information/Ticketing	Advisory
County/Unitary/ Met District	Parking Pricing	Introduction of Clean Air Zones, Congestion Charging, Workplace Parking Levy	Strategic and Business Case Development and Delivery Roadspace Allocation (Bus and Cycle Lanes) Parking Provision (Public and On-street) Charge Points	Bus Partnerhsips Managing Socially Necessary Services (if Not C.A.) Integrating Information/Ticketing	Strategic Plans (County) or Local Plans and Planning Approvals
Local District	Parking Pricing		Parking Provision (Public and On-street) Charge Points		Local Plans

5. Conclusions

The Paris Agreement has crystallized some carbon reduction realities which have profound impacts on what needs to happen next and how that must be delivered. First, the use of budgeting frameworks is now demonstrating to policymakers how late deep emissions cuts have been left and how hard this will be to deliver. While there remain quite substantial differences in framings about shared burdens and negative emission technologies, the rate of annual emission reductions required far exceeds the progress ever achieved in a range of sectors and particularly so for transport, the focus area of this paper. The second is that, coupled with a requirement for deep cuts in the coming decade, there is at most 30 years to completely decarbonize all sectors and in all parts of the country.

This paper has demonstrated that in the UK, a country which has taken a leading role in committing to a transition to a zero carbon economy, there is no currently coherent framework for understanding the role of different levels of government in this transition. The requirement to act is not a unique property of an international accounting system or the national governments tasked with negotiating and reporting on their progress. Local populations and their governments are also responding. In the absence of a clear framework beneath the national level, the response is piecemeal and incoherent. In light of our analysis, we think it is impossible to defend the position that setting a clear framework for responsibility sharing would create more problems than it would solve.

Our analysis shows that there is no one optimal spatial scale for allocating budgets due to the different alignment of policy competencies and distribution of emissions. This paper has identified three dimensions of the problem that require coordination across scales and which can form the basis of choosing pragmatic ways forward right now. Most authorities are still in the process of working out what the declaration of a climate emergency means and thus can build this in immediately. The urgency of cutting emissions early in the period to 2050 means we cannot afford a call for coordination to be interpreted as an opportunity for delay.

The three components identified that shape how to coordinate action are as follows:

- Budget coherence, where the gap between framings of what the Paris Agreement means are creating radically different ambition levels. Coupled with this are incon-

sistencies even within areas that have budgets as well as between places that do and do not have any form of budgeting. There must, at the very least, be some form of budgeting at a subnational scale below that of devolved administrations.

- Accounting coherence, as accounting at the smaller scales of local government alone appears too limited in managing the full range of carbon impacts from transport. Carbon accounting coherence in transport significantly improves at a combined authority, city region or shire county scale, and there are still important flows at a sub-national authority scale.
- Policy coherence, because of the patchwork of powers and structures across the UK, there is no one prescription for how this will work. A multi-scalar approach seems, therefore, both inevitable and appropriate. It is difficult to envisage policy coherence, however, without agreement over how much action is needed and what needs to be counted where, as set out in the budget and accounting coherence.

The scale of the changes that are now implied by the carbon budgets and pathways will require adaptations to ways of life which will be deeply political, and so there has to be clarity, accountability and fairness in the allocation of responsibilities and resources to match if we are to expect the local, regional and national contributions to add up [47]. There has, as yet, been no discussion about how to deal with key equity issues, such as how to treat places with historically high emissions, lower long-term investment in alternatives to the car, high (or low) levels of co-benefits with other policy areas or socioeconomic and geographic circumstances that might influence the pace of action in different places [48]. If, as Willis suggests, the success or failure of the race to cut emissions will be won or lost on the basis of bringing the public along with the realities of the choices implied by the budget [14], then we cannot afford to persist with the muddle of approaches being enacted today. A clear framework for carbon management should provide a more robust and transparent assessment of what needs to be done where and by when. It is time to stop hiding the realities of the scale of the carbon reduction challenge in transport and the need for action everywhere.

Author Contributions: Conceptualization, G.M. and J.A.; methodology, G.M., writing—original draft preparation, G.M.; writing—review and editing, J.A. and G.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Engineering and Physical Sciences Research Council (EPSRC) under the DecarboN8 grant EP/S032002/1 and the CREDS Centre EP/R035288/1. The APC was funded by EPSRC.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data on the Sixth Carbon Budget is available to download from https://www.theccc.org.uk/wp-content/uploads/2021/02/The-Sixth-Carbon-Budget-Dataset.xlsx, Accessed 1 on June 2021 and data on the local authority territorial emissions by sector is available from https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas. Accessed on 1 June 2021.

Acknowledgments: We would like to thank Kadambari Lokesh for her work in reviewing the declarations of climate emergencies referred to in Section 1 as part of the DecarboN8 project.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. IPCC. *Global Warming of 1.5C. An IPCC Special Report on the Impacts of Global Warming above Pre-Industrial Levels and Related Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development and Efforts to Eradicate Poverty*; Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D., J.Skea, P.R., Shukla, A., Pirani, W., Moufouma-Okia, C., Péan, R., et al., Eds.; IPCC: Geneva, Switzerland, 2018.

2. Anderson, K.; Broderick, J.F.; Stoddard, I. A Factor of Two: How the mitigation plans of 'climate progressive' nations fall far short of Paris compliant pathways. *Climate Policy* **2020**. [CrossRef]
3. Lebling, K.; Levin, K.; Jeffery, L.; Plechaty, D.; Ge, M.; Friedrich, J.; Waite, R. Climate Action Must Progress Far Faster to Achieve 1.5 C Goal, World Resources Institute. 2019. Available online: https://www.wri.org/blog/2020/11/climate-action-progress-2030-2050 (accessed on 26 March 2021).
4. Rogelj, J.; Forster, P.M.; Kriegler, E.; Smith, C.J.; Séférian, R. Estimating and tracking the remaining carbon budget for stringent climate targets. *Nature* **2019**, *571*, 335–342. [CrossRef]
5. Bache, I.; Bartle, I.; Flinders, M.; Marsden, G. Blame games and climate change: Accountability, multi-level governance and carbon management. *Br. J. Politics Int. Relat.* **2014**, *17*, 1–20. [CrossRef]
6. Marsden, G.; Ferreira, A.; Bache, I.; Flinders, M.; Bartle, I. Muddling through with climate change targets: A multi-level governance perspective on the transport sector. *Climate Policy* **2014**, *14*, 617–636. [CrossRef]
7. UNFCC. *Decision 1/CP.21, Paris Agreement, United Nations Framework Convention on Climate Change*; Document FCCC/CP/2015/10/Add.1; United Nations: Paris, France, 2015.
8. Anderson, B. From long-term targets to cumulative emission pathways: Reframing UK climate policy. *Energy Policy* **2008**, *36*, 3714–3722. [CrossRef]
9. Bache, I.; Reardon, L.; Bartle, I.; Flinders, M.; Marsden, G. Symbolic Meta-Policy: (Not) Tackling Climate Change in the Transport Sector. *Political Stud.* **2015**, *63*, 830–851. [CrossRef]
10. Zhao, R.; Min, N.; Geng, Y.; He, Y. Allocation of carbon emissions among industries/sectors: An emissions intensity reduction constrained approach. *J. Clean. Prod.* **2017**, *142*, 3083–3094. [CrossRef]
11. Steininger, K.W.; Meyer, L.; Nabernegg, S.; Kirchengast, G. Sectoral carbon budgets as an evaluation framework for the built environment. *Build. Cities* **2020**, *1*, 337–360. [CrossRef]
12. Climate Emergency Declaration. Available online: https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/ (accessed on 25 March 2021).
13. List of Councils Who Have Declared a Climate Emergency. Available online: https://www.climateemergency.uk/blog/list-of-councils/ (accessed on 30 January 2021).
14. Willis, R. *Too Hot to Handle? The Democratic Challenge of Climate Change*; Bristol University Press: Bristol, UK, 2020.
15. 2019 UK Greenhouse Gas Emissions, Provisional Figures, 26 March 2020, National Statistics. Available online: https://data.gov.uk/dataset/9a1e58e5-d1b6-457d-a414-335ca546d52c/provisional-uk-greenhouse-gas-emissions-national-statistics (accessed on 11 March 2021).
16. Harstaad, H. Do Climate Targets Matter? The accountability of climate target setting in urban climate and energy policy. In *Enabling Sustainable Energy Transitions: Practices of Legitimation and Accountable Governance*; Sareen, S., Ed.; Palgrave MacMillan: London, UK, 2020; pp. 63–72.
17. Balouktsi, M. Carbon metrics for cities: Production and consumption implications for policies. *Build. Cities* **2020**, *1*, 233–259. [CrossRef]
18. Harris, S.; Weinzettel, J.; Bigano, A.; Källmén, A. Low carbon cities in 2050? GHG emissions of European cities using production-based and consumption-based emission accounting methods. *J. Clean. Prod.* **2020**, *248*, 119206. [CrossRef]
19. Leão, E.B.S.; do Nascimento, L.F.M.; de Andrade, J.C.S.; de Oliveira, J.A.P. Carbon accounting approaches and reporting gaps in urban emissions: An analysis of the Greenhouse Gas inventories and climate action plans in Brazilian Cities. *J. Clean. Prod.* **2020**, *245*, 118930. [CrossRef]
20. OECD Recommendation of the Council on Policy Coherence for Sustainable Development, OECD/LEGAL/0381. Available online: https://www.oecd.org/gov/pcsd/oecd-recommendation-on-policy-coherence-for-sustainable-development.htm (accessed on 21 May 2021).
21. Levin, K.; Cashore, C.; Bernstein, S.; Auld, G. Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change. *Policy Sci.* **2012**, *45*, 123–152. [CrossRef]
22. Low, N.; Astle, R. Path dependence in urban transport: An institutional analysis of urban public transport in Melbourne Australia, 1956–2006. *Transp. Policy* **2009**, *16*, 47–58. [CrossRef]
23. Sorenson, A. Taking path dependence seriously: An historical institutionalist research agenda in planning history. *Plan. Perspect.* **2015**, *30*, 17–38. [CrossRef]
24. Sixth Carbon Budget, Climate Change Committee, London, 9th December. 2020. Available online: https://www.theccc.org.uk/publication/sixth-carbon-budget/ (accessed on 25 March 2021).
25. Sixth Carbon Budget Dataset. Available online: https://www.theccc.org.uk/wp-content/uploads/2021/02/The-Sixth-Carbon-Budget-Dataset.xlsx (accessed on 25 March 2021).
26. Connecting Leeds: Transport Strategy, Draft for Consultation. Available online: https://leedstransportstrategy.commonplace.is/overview (accessed on 25 March 2021).
27. Tackling the Climate Emergency: Emissions Reduction Pathway Report, West Yorkshire Combined Authority and Leeds City Region Enterprise Partnership, July. Available online: https://www.westyorks-ca.gov.uk/media/4268/emission-reduction-pathways-report.pdf (accessed on 25 March 2021).

28. Emissions of Carbon Dioxide for Local Authority Areas. Department of Business, Energy and Industrial Strategy. Available online: https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas (accessed on 25 March 2021).
29. Wilson, R.E.; Anable, J.; Cairns, S.; Chatterton, T.; Notley, S.; Miller, J.D. On the estimation of temporal mileage rates. *Transp. Res. E Logist. Transp. Rev.* **2013**, *60*, 126–139. [CrossRef]
30. Transport Outlook. International Transport Forum, Paris. 2019. Available online: https://www.oecd-ilibrary.org/transport/itf-transport-outlook-2019_transp_outlook-en-2019-en (accessed on 25 March 2021).
31. Brand, C.; Anable, J.; Ketsopolou, I.; Watson, J. Road to zero or road to nowhere? Disrupting transport and energy in a zero carbon world. *Energy Policy* **2020**, *139*, 111134. [CrossRef]
32. Government Takes Historic Step towards Net-Zero with End of Sale of New Petrol and Diesel Cars by 2030, Press Release from Department for Transport, Office for Zero Emission Vehicles and Department for Business, Energy and Industrial Strategy, 18th November. Available online: https://www.gov.uk/government/news/government-takes-historic-step-towards-net-zero-with-end-of-sale-of-new-petrol-and-diesel-cars-by-2030 (accessed on 25 March 2021).
33. Gota, C.; Huezinga, C.; Peet, K.; Medimorec, N.; Bakker, S. Decarbonising transport to achieve Paris Agreement targets. *Energy Effic.* **2019**, *12*, 363–386. [CrossRef]
34. Lefevre, J.; Briand, Y.; Pye, S.; Tovilla, J.; Li, F.; Oshiro, K.; Waisman, H.; Cayla, J.M.; Zhang, R. A pathway design framework for sectoral deep decarbonization: The case of passenger transportation. *Clim. Policy* **2021**, *21*, 93–106. [CrossRef]
35. Creutzig, F. Evolving narratives of low-carbon futures in transportation. *Transp. Rev.* **2016**, *36*, 341–360. [CrossRef]
36. Salon, D.; Sperling, D.; Meier, A.; Murphy, S.; Gorham, R.; Barrett, S. City carbon budgets: A proposal to align incentives for carbon friendly communities. *Energy Policy* **2010**, *38*, 2032–2041. [CrossRef]
37. Vagnoni, E.; Morati, A. Local Government's contribution to low carbon mobility transitions. *J. Clean. Prod.* **2018**, *176*, 486–502. [CrossRef]
38. Tólon-Becerra, A.; Lastro-Bravo, X.B.; Sotelo-Navoporto, J.A. Territorial distribution of transport emission reduction targets from an environmental, economic and social viewpoint. *Environ. Sci. Policy* **2012**, *16*, 97–113. [CrossRef]
39. Azevedo, I.; Horta, I.; Leal, V.M. Analysis of the relationship between local climate change mitigation actions and greenhouse gas emissions–Empirical insights. *Energy Policy* **2017**, *111*, 204–213. [CrossRef]
40. Marsden, G.; Docherty, I. *Governance of UK Transport Infrastructures. UK Government Office for Science. Future of Mobility: Evidence Review*; Government Office for Science: London, UK, 2019. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/780871/governance.pdf (accessed on 25 March 2021).
41. MacKinnon, D.; Shaw, J.; Docherty, I. *Diverging Mobilities: Devolution, Transport Policy and Innovation*; Elsevier Science: Oxford, UK, 2008.
42. MacKinnon, D.; Shaw, J. New state spaces, agency and scale: Devolution and the regionalisation of transport governance in Scotland. *Antipode* **2010**, *42*, 1226–1252. [CrossRef]
43. Marsden, G. The Role of Sub-National Transport Bodies in Carbon Governance, DecarboN8 working paper 3.1. 2020. Available online: https://decarbon8.org.uk/sntbs-carbon-governance/ (accessed on 25 March 2021).
44. Sandford, M. Local Government in England: Structures, Briefing Paper 07104, Library of the House of Commons, 20th November, London. 2020. Available online: https://commonslibrary.parliament.uk/research-briefings/sn07104/ (accessed on 25 March 2021).
45. Liu, Z.; Geng, Y.; Dong, H.; Wilson, J.; Micic, T.; Wu, R.; Cui, X.; Qyian, Y.; Yu, W.; Sun, H. Efficient distribution of carbon emissions reductions targets at the city level: A case of Yangtze River Delta region. *J. Clean. Prod.* **2018**, *172*, 1711–1721. [CrossRef]
46. Hermannson, K.; McIntyre, S.G. Local consumption and territorial-based accounting for CO_2 emissions. *Ecol. Econ.* **2014**, *104*, 1–11. [CrossRef]
47. Gordon, D.J.; Johnson, C.A. City networks, global climate governance and the road to 1.5C. *Curr. Opin. Environ. Sustain.* **2018**, *30*, 35–41. [CrossRef]
48. Walker, R.; Morgan, M.; Marsden, G.; Anable, J. Carbon Accounting for Local Authorities: A Comparative Analysis of NAEI Estimates and MOT Test Data Based Estimates, DecarboN8 Working Paper 1.1. 2020. Available online: https://decarbon8.org.uk/wp-content/uploads/sites/59/2020/09/DecarboN8-WP1.1-Walker-et-al-2020-1.pdf (accessed on 25 March 2021).

MDPI
St. Alban-Anlage 66
4052 Basel
Switzerland
Tel. +41 61 683 77 34
Fax +41 61 302 89 18
www.mdpi.com

Sustainability Editorial Office
E-mail: sustainability@mdpi.com
www.mdpi.com/journal/sustainability

MDPI
St. Alban-Anlage 66
4052 Basel
Switzerland

Tel: +41 61 683 77 34
Fax: +41 61 302 89 18

www.mdpi.com

ISBN 978-3-0365-4268-3