Driving the Decarbonizing City: The role of electric vehicles in Dublin's sustainability transition.

Conchúr Ó Maonaigh (14416872)

Head of Department: Dr Stephen McCarron

Primary Supervisor: Dr Alistair Fraser (Maynooth University)

Secondary Supervisor: Dr Patrick Bresnihan (Maynooth University)

Thesis submitted in fulfilment of the requirements of the PhD degree,

Department of Geography, Faculty of Social Sciences, Maynooth University.

Submitted: August 2023

Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university. I further declare that this research has been carried out in full compliance with the ethical research requirements of Maynooth University.

Signed:

Conchúr Ó Maonaigh
August 2023

Permission to lend and/or copy

I agree that Maynooth University may lend or copy this dissertation upon request.

Signed:

Conchúr Ó Maonaigh
August 2023

This page has been left intentionally blank.

Abstract

The notion of 'sustainability transition' has recently gained traction in human geography. At issue are the emerging dynamics and material configurations underlying the spaces, modalities, and pathways associated with decarbonisation. This thesis examines the role of electric vehicles (EVs) and associated infrastructures in sustainability transitions in Dublin, Ireland. The Irish government, driven in large part by regulations set at the EU level, has introduced a series of initiatives to establish an EV market in Ireland. In turn, Dublin has become a key location for state-led but market-oriented experimental projects and interventions aimed at facilitating the sale and use of EVs. Many of these projects fail to live up to the sustainability hype and tend to enrol users in the promotion, management, and governance of decarbonisation in chaotic but as-of-yet uncharted ways. Against this general backdrop, I draw upon scholarship on the multi-level perspective (MLP), urban political ecology (UPE), and Marxian approaches to urban development to examine how the emergence of alliances between public and private actors alongside EV users produce new practices, spaces, and fixes aimed at shaping the shift towards in EVs in Dublin. I use a qualitative analysis of 72 semi-structured interviewers with the 'drivers' who steer the shift towards EVs: 39 EV users; 23 representatives from Irish and international firms operating in and around the EV sector (e.g., automotive dealerships and charge point installation companies); and ten interviews with respondents from the public sector and regulatory bodies. I advance a theoretical framework, which I refer to as Critical Urban Transition Studies (CUTS), to analyse the differentiated structures, agency, and power relations that underpin Dublin's sustainability transition. By applying CUTS to Dublin, I examine how neoliberalization is entangled with relations, actions, and pathways that underpin the shift towards EVs. As a result, an inadequate, disordered, and unequal decarbonisation project emerges that exerts pressure on the actors involved to forge alliances that are capable of pivoting, circumventing, or fixing, for a time at least, some of the tensions emerging from the chaotic unfolding of EVs and associated infrastructures in the city. I make three wider contributions to geographical knowledge: First, I identify several ways that neoliberal policymaking and experimentation affect urban sustainability transitions; second, I expand on the concept of cross-class alliances to examine how coalitions between technology users and public and private sector actors shape the city; finally, I build on the notion of ‘the glitch’ to apprehend the relationship between neoliberalism and digital technologies in shaping decarbonisation.

This page has been left intentionally blank.

Table of contents

List of figures

List of tables

Chapter 1: Introduction

1.1 Introduction

The effects of anthropogenic climate change on the Earth's natural systems are beginning to emerge at an alarming rate. The planet experienced its hottest-ever month on record in July 2023 (WMO, 2023); a month earlier, the Antarctic Sea ice extent reached a historic low (NOAA, 2023); and recently published research estimated with high confidence that the Atlantic meridional overturning circulation (AMOC) is likely to collapse around mid-21st century under the current scenario of future emissions (Ditlevsen & Ditlevsen, 2023). In addition, extreme weather events have marked these large-scale environmental shifts, such as the 2023 Canadian wildfires that displaced over 168,000 people (Shakil, 2023); the 2022 South Asian Floods that killed approximately 1,717 people in Pakistan (Islamic Relief, 2022); and the 2020–2023 Horn of Africa drought, in which 23 million people faced extreme hunger, 3.3 million were displaced, and 8.9 million livestock died (Ellerbeck, 2023; UNOCHA, 2022). The news cycle is dominated by stories of the far-reaching and destructive consequences of climate change.

In response to the climate problem, the 2015 Paris Agreement set out legally binding and universal targets to reduce emissions by 43 per cent by 2030 and limit global warming to 1.5°C (UNFCC, 2023). Since the agreement entered into force in November 2016, there has been a global shift in efforts to decarbonise society. In the period between 2017 and 2023, the global net renewable electricity capacity doubled from around 180 GW to 440 GW (IEA, 2023a, p. 19); the global electric vehicle (EV) stock grew from approximately 6 million to 27 million (IEA, 2023b, p. 15); and government spending on research and development for sustainable innovations rose globally by over $10 billion (IEA, 2023c, p. 134). Despite these shifts in the energy system, the United Nations Environment Programme (UNEP, 2022) reported that even with the existing policies set out by member states, the planet is likely to experience a 2.8°C increase in global average surface temperatures, "…highlighting a gap between national commitments and the efforts to enact those commitments (p. xv)." There is, therefore, evidence of a global decarbonising project taking shape; but there are severe doubts about whether it can sufficiently address the climate problem.

Considering that 56 per cent of the world's population live in cities (World Bank, 2023); and that urban areas consume between 67-76 per cent of global energy use and generate between 71-76 per cent of carbon dioxide (CO_2) emissions (IPCC, 2022b, p. 866), it should come as no surprise that cities have become key arenas for low-carbon restructuring projects. These projects differ in scope and scale. For geographers such as Cugurullo (2018) and Bulkeley and Broto (2013), low-carbon restructuring projects coalesce around the development of urban experimental models aimed at expanding the use of so-called 'sustainable' innovations, such as residential solar or electric vehicles (EVs). For others, such as While et al. (2010) and Hodson and Marvin (2010), these low-carbon restructuring projects are constitutive of the latest wave of urban planning and development that seek to balance the tensions between "economy–environment relations within capitalist states (While et al., 2010, p. 82)." At the same time, low-carbon restructuring projects "build internalized ecological resource flows that attempt to guarantee strategic protection and further economic reproduction [in cities] (Hodson & Marvin, 2010, p. 299)." Put differently, insofar as decarbonising the city entails the expansion of sustainable innovations and spaces, the processes at work must also be balanced against extant processes of capitalist accumulation.

It would be wrong to assume, however, that a single worldwide agenda to 'decarbonise the city' is taking shape. As While et al. (2010, p. 86) suggest, low-carbon restructuring develops in the context of "…distinctive national climate control regimes, as climate policy is mediated through different modes of socio-environmental regulation and different material contexts for carbon reduction." Against this general backdrop, the following dissertation examines efforts to decarbonise Dublin's transportation sector through the expansion and use of electric vehicles (EVs) and associated infrastructures. A key point to make at the outset is that efforts to decarbonise Dublin's transportation system take shape in a city dominated by car ownership. Around two million people live in the Greater

Dublin Area (GDA), with 50 per cent of commuters travelling daily by car, and 78 per cent of households owning at least one vehicle (CSO, 2016a; 2016b).[1] At the national level, Ireland's population has risen by around 45 per cent since the mid-1980s (CSO, 2023) but the number of licensed vehicles has increased by 215 per cent in the same period (CSO, 2022b). From an average of 915,000 cars in the mid-1980s, Ireland now has around 2.9 million vehicles. This shift towards car ownership has made transport Ireland's largest source of energy-related CO2 emissions. The transportation sector consumes 62 per cent of all the oil imported into the country. Oil constitutes 45 per cent of Ireland's primary energy needs (Government of Ireland, 2022, p. 7) and 87 per cent of Irish energy importation costs, at a total of €4.3 billion a year (SEAI, 2020, p. 19).

In response to these issues, the Irish government, in its Climate Action Plan set out a target of 845,000 EVs, on the road by 2030 (Government of Ireland, 2023a, p. 193). There were 84,000 EVs in Ireland in 2023, which has risen from about 1,000 in 2015 (SEAI, 2023; SIMI, 2023). In addition, there were approximately 2,500 public charge points available in 2022, and per the Society for the Irish Motor Industry (SIMI), the government's EV target would require around 100,000 fast charging points (Arup & Jim Power Economics, 2022). The Irish government's EV target has been controversial because the target appears to hinge on record-breaking automobile sales. As Caulfield (2023) suggested, the government target is "unrealistic [because] on average, [the Irish automobile market] sold about 100,000 cars per year in the country […] [reaching the EV target] by 2030 would mean selling more than 100,000 electric cars alone every year to 2030." In addition, the target proved controversial because the EV sector has been heavily subsidised by the Irish government, which has provided around €320 million in subsidies since 2012 (PBO, 2022). EV buyers tend to be among the wealthiest members of Irish society. In fact, Caulfield (2022) highlights how domestic EV charging infrastructures are primarily situated in the country's wealthiest neighbourhoods. In addition, politicians such as Darren O'Rourke, TD

[1] The Greater Dublin Area consists of the counties Dublin, Kildare, Wicklow, and Meath

(member of the Irish parliament) argued that the current subsidy model "…doesn't help the vast majority of workers and families, as EVs remain out of their financial reach (O'Doherty, 2021)." Others, such as Jennifer Whitmore TD, described the subsidies as "…a major transfer of wealth to those who do not need it (Drennan, 2022)."

Across the globe, many states have put in place similar incentives to promote the sales of EVs; Germany has provided grants of up to €4,000 per EV to reach the target of 15 million EVs on the road by 2030 (Federal Ministry for Economic Affairs and Climate Action, 2023); the UK has introduced low-emissions zones with the expectation that 80 per cent of all new car sales will be electric by 2030 (UK Department for Transport, 2023); even the US has provided tax credits to EV users with a view to making 50 per cent of all new vehicle sales electric by 2030 (Shepardson, 2023). Furthermore, several macroeconomic policies have emerged globally to support the shift to EVs. The US Inflation Reduction Act (IRA) has dedicated $369 billion for climate investments, including the Advanced Manufacturing Production Tax Credits, where the US government will provide subsidies for domestic EV battery production (IEA, 2023b, p. 67). Along similar lines, the EU's Green Deal Industrial Plan has announced its efforts to progress the shift to EVs by supporting faster permissions for planning and development and announced its intention to reduce barriers to state aid (IEA, 2023b, p. 68). Overall, these supports have encouraged the auto industry to restructure. A report by Reuters (2022) indicated that automakers intend to invest $1.2 trillion in EV production by 2030.

Geographers have paid attention to the turn to EVs. Jerez et al. (2021), for example, focus on what they describe as 'the colonial shadow of green electromobility' in which "the expansion of lithium demand […] promoted by the new green economy and its CO2 reduction policies in the Global North […] has been generating socio-environmental damages and water injustices in the Global South (p. 2)." This colonial shadow is constitutive of the host environmental-economic tensions that shape the EV transition. Others, such as Henderson (2020), have shined a light on how the current trajectory of EV technologies "might escalate rather than reduce global resource and energy demand" (p. 1993). In addition, Henderson argues that EV demand undermines other, potentially more sustainable forms of transport, such as cycling and public transport. Considering the infrastructure arrangements of EVs, Kester (2018) demonstrates how the emergence of EV charging creates new insecurities in automobility and electricity systems that give rise to phenomena such as range anxiety. Overall, the literature illustrates why decarbonising transportation is often understood as the "hardest case" of sustainability transition (Geels et al, 2013, p. xiii, see also: Tyfield, 2013; Tyfield, 2014).

I argue that geographical analyses of EVs tend to play down the emergent interventions and relations of neoliberal states, capitalist firms, and EV users. My argument is that these agents and their interactions are fundamental to the place-specific dynamics and material configurations of EVs. In other words, understanding the spaces, modalities, and pathways of decarbonisation demands a type of analysis that can engage with the everyday realities of agents who drive socio-spatial change. Moreover, geographic scholarship on EVs has tended to silo analysis of the global EV project to specific dynamics, for example, separating the infrastructural arrangements from the EV adoption and use. My goal is to shine a light on these connections and, thus, bring to the surface the deep entanglements between technology, nature, and capital that underlie efforts to decarbonise cities. There is also a further set of novelties that have been absent from any geographical analysis. Consider the UNEP report (2022), which suggests that current policies are likely to be ineffective at limiting global warming to a meaningful rate or the controversies surrounding the Irish government's 'unrealistic' EV target (O'Donoghue, 2023). I argue that such inadequacies are central characteristics of the decarbonising process and, by extension, must be understood as generative in shaping the city.

In this dissertation, I draw on an analysis of qualitative fieldwork on the dynamics of Dublin's turn to EVs to examine the emerging relations and actions shaping the shift towards EVs. I argue that the Irish state and capitalist enterprises cannot produce the complex geographies required to decarbonise alone; they cannot establish the place-specific infrastructures as well as the socio-cultural and institutional mixes needed to facilitate the flows of capital in cities. Therefore, to stimulate the transition and enable the conditions for accumulation, I argue that the state and capitalist enterprises rely on local firms and EV users who seek to pivot, circumvent, or find fixes to the tensions presented by Dublin's inadequate decarbonising project. The upshot is deepening neoliberalism via decarbonisation, whereby the relations, actions, and pathways underpinning the shift towards EVs produce a restructuring project that is more intent on restoring class power than pursuing decisive and timely decarbonising action.

1.2 Theoretical underpinnings

The inner connections between states, fossil fuels, and the global economy go a long way to explain why society has not transitioned to a low-carbon economy. Coal, gas, and oil are the primary sources of carbon emissions but are *also* lucrative commodities that underpin how much of the world produces electricity, heats buildings, and propels engines. Moreover, these fuels provide source material for products such as plastic and solvents, with petrochemical feedstock accounting for 14 per cent of global oil demand (IEA, 2018, p. 27). Thus, Huber (2013, p. xi; citing Yergin, 1990) describes oil as the 'lifeblood' of capitalism, in which "the struggle for the oil 'prize' is a "great game" between powerful actors with the globe as their stage." Yet, its power is reinforced by "…the fact that oil is also incredibly *ordinary* because it is embedded in everyday patterns of life." The continuous expansion and use of fossil fuels like oil since the emergence of industrial capitalism have naturalised how much of the world's industries, occupations, and everyday social relations depend on them. If a different energy regime is now emerging, it is necessary for geographers to pay attention.

Reacting to the need to create pathways towards low-carbon futures, geographers have turned their attention to the notion of 'transition studies' (see: Gailing & Moss, 2016; Lawhon & Murphy, 2012) to conceptualise the diverse trajectories of change that might enable decarbonisation to emerge. Much of this scholarship has developed in conversation with theories of socio-technical systems, science and technology studies, and evolutionary economics (Geels, 2012). The focus of transition studies has coalesced around examining the ways in which so-called 'sustainable' niche innovations, such as residential solar or electric vehicles (EVs), disrupt or integrate into existing technological regimes. Transitions here are understood through "…iterative, incremental processes of change, towards uncertain futures (Brown, et al., 2012, p. 1608)." More recently, however, 'transition thinking' has gained traction in critical geographic scholarship to critique the orthodox formations and dominant ideologies underlying the decarbonising process and envision ways in which society might move towards more post-capitalist alternatives. My aim is to think about and through the notion of transition to examine the emergence of the decarbonising process and consider the implication of these changes; might the decarbonising process give rise to a new 'lifeblood' for capitalist economies or can a radically alternative future be on the horizon. Considering these dilemmas, I focus on three diverse strands of 'transition thinking'. Each approach has analytical and normative qualities.

The first strand relates to the notion of 'sustainability transition', which has emerged as a type of new orthodox approach for examining efforts to decarbonise society. The notion of sustainability transition has its roots in socio-technical transitions. As a result, the focus of this body of work relates to the "…changes from one socio-technical system to another, involving co-evolution of technology and society (Geels, 2005, p. 363)." A prominent framework on sustainability transitions, which I draw upon in this dissertation, is the multi-level perspective (henceforth the MLP) (see: Geels, 2012; Geels, 2019; Berkeley, et al., 2017). The MLP is a middle-level framework that seeks to examine the ways in which actors adopt and mobilise sustainable niche innovations to provoke larger transformations within the socio-technical systems. In short, innovations disrupt or integrate into existing regimes in ways that might yield socio-spatial changes that can provoke or limit the capacity for a more sustainable society to emerge. Sustainability transition frameworks such as the MLP invite an analysis of the every day and context-specific struggles experienced by actors who seek to anchor or expand decarbonising technologies into specific selection environments.

The second strand relates to geographic scholarship on the notion of just transition, which has sought to bring a more critical edge to transition thinking by focusing on the uneven distributions of power, wealth, and opportunities that drive socio-spatial change. Connecting with a wider terrain of literature on social, spatial, environmental, and mobility justice, this body of work emphasises the need to ensure a fair and equitable transition for both human and non-human life. One influential field with a focus on just transition has been urban political ecology (henceforth UPE) insofar as it directs attention to the socio-natural processes that shape transitions across a variety of scales (see: Angelo & Wachsmuth, 2014; Keil, 2003; Swyngedouw & Heynen, 2003). Consider that the ecological shifts underlying the decarbonising city may have far-reaching and destructive consequences for the social, economic, and environmental conditions of distant geographies. UPE foregrounds a type of approach to just transition that takes seriously "…the (changing) dependence of capital accumulation on nature [and] to ask serious questions about the multiple power relations […] through which deeply unjust socio-environmental conditions are produced and maintained (Swyngedouw & Heynen, 2003, pp 902, 907)."

The third and final strand, which connects with transition studies, relates to the notion of 'revolutionary transition'. Along similar lines to scholarship on just transition, a focus on revolutionary transitions foreground the inequalities entangled in orthodox approaches to decarbonisation. However, as the revolutionary title suggests, this nascent scholarship adopts a more antagonistic stance toward capitalism. In focus here are what I refer to as Marxian approaches to urban development that emphasise the ways in which the actions that drive the decarbonising city aim to create the conditions that enable extant processes of exploitation and the unequal social structures and systems that define capitalist systems to be reproduced (see: Harvey, 1985a; 1985b; Cox, 2010). This approach shines a light on how capitalist classes and elites seek to stake a claim in the future of cities by shaping the pathways to a low-carbon society. Moreover, this approach seeks to envision concrete and emancipatory alternatives.

I argue that combining elements of each strand permits a critical analysis of the spaces, pathways and modalities that underpin urban transition. In the following dissertation, then, I draw upon the scholarship from the multi-level perspective (MLP) on sustainability transitions, urban political ecology, and Marxian approaches to urban development to construct an original research framework, which I refer to as 'critical urban transition studies' (henceforth CUTS). I introduce this framework in Chapter 2 and assess its utility throughout the dissertation. I argue that CUTS can help to evaluate whether the current spaces, pathways, and modes of the decarbonising project can and are producing the necessary changes needed to avoid runaway climate change. Moreover, my aim is to understand how the interplay between nascent innovations, nature, and society across a variety of scales provokes shifts in the fabric of society and how such shifts interact with the extant power relations and structures that created the climate problem in the first place.

1.3 Research aims and questions.

Considering the theoretical underpinnings of my research (highlighted above), I now turn to my research aims and questions. I organise my research around the following five research aims.

First, my research aims to examine the role policy and technological experimentation play in shaping the governance, development, and experience of using EVs and their associated infrastructure in Dublin.

Second, my research aims to explore the less noticeable connections between the experimentation and technological trajectory of Dublin EV project and the wider socio-ecological transformations born from the decarbonising process.

Third, my research aims to investigate the public and private sector interventions aimed at steering the pathways towards EVs in Dublin and how this interplay between the state and capital seeks relates to dynamics of accumulation in city's transport sector.

Fourth, my research aims to examine the structure of class relations involved in the formation of new accumulation strategies, spaces, and fixes that underlie the turn to EVs.

Fifth, my research aims to examine the unique digital characteristics of Dublin's turn to EVs and how these traits shape the experiences of EV users.

Taken together, each research aim is designed to enable me to explore the utility of my conceptual framework or what I refer to as 'critical urban transition studies' (CUTS)

In addition to these aims, I conducted research with the following questions in mind. My central research question asks: *How do alliances of public-private actors and EV users assemble, mobilise, and drive efforts to decarbonise Dublin's transportation sector?* More specifically, I ask: (1) What are the types of relationships emerging between the actors driving to decarbonise Dublin's transportation sector? (2) How do actors driving the decarbonisation process encounter and overcome obstacles in their path? (3) What are the experiences of using, promoting, or governing decarbonising technologies like? I revisit these research questions in Chapter 3 when outlining my research design and methodological strategy.

1.4 Outline of the chapters

In Chapter 2, I introduce my theoretical framework by placing scholarship from three separate fields into conversation with one another. I draw from literature engaging the multi-level perspective (MLP) on sustainability transitions, urban political ecology (UPE), and Marxian approaches to urban development to advance an approach under what I refer to as critical urban transition studies (CUTS). I begin by reviewing the key contributions each field has made to scholarship on social, environmental, and economic transitions in urban environments. I then synthesise aspects from these fields to refine my approach to the research. I argue that the MLP can help to shed light on the ways in which economic agents succeed and/or fail to configure decarbonising technologies and infrastructures at the local scale; that UPE can offer an understanding as to how economic agents enrol socio-natural processes to shape the forms and frames of sustainability transitions in cities; and that Marxian approaches can assist in analysing how power and class dynamics are fundamental in the development of sustainability transitions. These bodies of work provide a context as to how urban transitions develop out of the imaginaries and anticipatory actions of states, firms, and individuals who seek to shape potential futures.

In Chapter 3, I outline the methodology that was used to generate the empirical data used in this research. I begin by providing an overview of my research design and questions. I then reflect on my methodological strategy and my methods in practice. I chose a qualitative methodology because it provides an in-depth analysis of the viewpoints and social worlds of respondents from different social groups, in this case, EV users, public sector actors and private sector actors (Denzin & Lincoln, 2011). A key point here is that the Covid-19 pandemic prompted me to pivot my research activities to pursue what I refer to as a 'digitally immersed research methodology' whereby my fieldwork took place solely online from a remote location. I reflect on the specific dynamics of my digitally immersed research methodology, including my use of social media platforms for sampling and teleconferencing platforms such as Zoom and MS Teams for online interviewing. I also consider the implications my methodology had on my overall outcomes. I conclude the chapter by reflecting on the limitations of my methodology.

Chapters 4, 5, 6, and 7, are analytical chapters, which examine the core findings of the research. I identify four core findings: First, the shift towards EVs in Dublin can be understood as producing an 'inadequate infrastructure' that constrains the objective of decarbonising the city; second, Dublin's EV project is underpinned by 'incoherent imaginaries' regarding the so-called environmental reason for adopting, using, and expanding EVs; third, the turn to EVs is shaped by the 'inconstant and insufficient interventions' by the public and private sectors; and fourth that the EV project can be understood as giving rise to 'imaginative and iterative responses' by EV users to stabilise the EV project. I report on the evidence base that supports each core finding before outlining key secondary findings that helped to steer the direction of the wider research.

Chapters 4 and 5 are a joint exploration divided into two chapters in which I seek to examine the first, second and third core research findings while reflecting on the utility of my CUTS approach. In Chapter 4, I examine the first two core research findings relating to 'inadequate infrastructures' and 'incoherent imaginaries' that underlie the EV project. I begin by drawing upon scholarship engaging the MLP to trace and analyse 'the inadequate infrastructures' emerging from Dublin's first EV charging network, which was constructed and designed under a pilot scheme known as 'the EV pilot project'. I then draw from scholarship engaging UPE to explore the contradiction, conflicts and tensions entangled with the socio-natural imaginaries driving Dublin's turn to EVs. My goal in this chapter is to shine a light on the less noticeable or obscure connections between niche 'sustainable' technologies, such as EVs, and the ecologies that underpin their adoption, expansion, and use.

In Chapter 5, I focus on the third core finding relating to the 'inconstant and insufficient interventions' made by the public and private sectors. I offer a detailed analysis of two public sector interventions that bring to the surface the role of semi-state bodies and local authorities in shaping Dublin's transition to EVs. I follow this analysis with a corresponding examination of the private-sector interventions pursued by automobile and charge point operation (CPO) firms. I also provide a case study on an indigenous CPO firm operating in Dublin to demonstrate the ways in which the wide terrain of public and private sector interventions interacts with one another and 'come to ground' in the city. I argue that these inconstant and insufficient interventions exert pressure on local actors to try to stabilise the EV project. I finish this chapter by discussing how the turn to EVs must be understood as emerging in the context of 'actually existing neoliberalism' in Dublin (see: Hearne, 2014; Mercille & Murphy, 2019).

In Chapter 6, I utilise a paper I recently published (Ó Maonaigh, 2023), which draws upon my doctoral research to examine the fourth core finding that relates to the 'imaginative and iterative responses' by EV to stabilise the EV project. In this chapter, I examine the odd structure of class relations involved in the formation of new accumulation strategies, spaces and fixes capable of holding together, for a time at least, some of the tensions emerging from the chaotic unfolding of EVs and associated infrastructures in cities. I argue that EV users in Dublin pursue and forge novel cross-class alliances with automobile firms to promote EVs and cement private and commercial automobility as the core of the decarbonisation agenda. I argue for the need to conceptualise the decarbonising action of EV users as part of a wider class project intended to enrol wealthier users in a push to alter the city and produce uneven pathways of decarbonisation. I have attached an authorship declaration form in Appendix A of this dissertation.

In Chapter 7, I synthesise the four core findings and consider how they have interacted with my research methodology to shape my research outcomes. I draw from scholarship in digital geography to critically analyse the presence of glitches, breakdowns and failures in the technologies and infrastructural configurations underlying the EV project. I examine how breakdowns in the digital systems underlying EVs reflect an approach to climate action that aims to devolve responsibility on users who seek to fix, circumvent, or ameliorate, for a time at least, some of the tensions emerging from a 'buggy and brittle' decarbonising project. The overall results of this chapter emerged as a surprising feature of doing digitally immersed research and reflected the ways in which digitalisation objectives intimately relate to the decarbonising process but in chaotic and potentially harmful ways.

I present the conclusions of the research in Chapter 8. I first provide a summary of the previous chapters and consider the ways in which future transition studies research might build upon the results. I then reflect on the under-examined findings of this dissertation that suggest avenues for postdoctoral research and beyond. I assess the limits of my CUTS approach and consider how the framework might be altered or refined to help critically examine sustainability and sustainability transitions in different socio-spatial contexts. Finally, I bring the dissertation to a close and consider its implications for policymakers and the wider field of Geography.

Chapter 2: Theorizing critical urban transition studies

2.1 Introduction

> "I can put it best with a phrase Marx used, when he spoke of the way we can rub different conceptual blocks together to make an intellectual fire… you try to rub the blocks together and ask: is there something that can come out of this which is a new form of knowing (Harvey, 2001, p. 9)."

On the 4th of April 2022, the IPCC finalised the third part of the sixth assessment report (AR6) on the mitigation of climate change. The report foregrounded the role of technology and infrastructural change in cities as part of the global decarbonising project and suggested that "the global trend of urbanisation also offers a critical opportunity in the near-term, to advance climate resilient development (IPCC, 2022a, p. 35)." With 68 per cent of the world's population expected to live in urban areas by the year 2050 (UNHabitat, 2022, p. 15), reports like AR6 are signalling a shift to new urban configurations constituted by individuals, firms, institutions, and governments oriented around the task of decarbonising the city (see: While, et al., 2010; Geels, 2012; Bulkeley, et al., 2014).

Against this backdrop, a body of work in geography and other disciplines has coalesced around the general theme of 'transition studies' (see: Gailing & Moss, 2016; Lawhon & Murphy, 2012). Much of this scholarship has emerged in conversation with theories of socio-technical systems, science and technology studies, and evolutionary economics (Geels, 2012). The objective is to understand how 'desirable' innovations for more sustainable societies are adopted or indeed resisted. In focus is a wide range of topics, including the inter-urban dynamics of so-called sustainability 'leader' and 'laggard' cities with respect to the global food industry (Pandey, et al., 2019); the *intra*-urban dynamics of cities – new urban sites, practices, and relationships – that facilitate and constrain the development of decarbonising policies and infrastructures (Rohracher & Spath, 2014). Transition studies *also* encompass normative and political approaches to societal change, including sustainable transitions, just transitions, degrowth agendas, or revolutionary transitions.[1]

In the following chapter, I build on these contributions to identify and examine what I refer to as 'critical urban transition studies' (CUTS). In Section 2.2, I focus on three broad areas within CUTS. The three areas are not an exhaustive list of critical fields that engage with transitions; rather, they mark valuable conceptual blocks that, when combined, can help researchers critically interrogate urban transitions. In following this approach, I try to build on Harvey's suggestion (above) that "a new form of knowing can come out of this."

The first area is the multi-level perspective (MLP) (Geels, 2012; 2014; 2019), a well-established framework in transition studies. Work using the MLP tends to envisage socio-technical change emerging from small, protected niches before reaching a much wider application. A core focus is on the contestation between actors who drive eco-innovations, such as residential solar or electric vehicles, to disrupt or integrate into incumbent fossil-based regimes, and thereby enact a transition to a more sustainable society. The second area of work in critical urban transition studies originates from urban political ecology (see especially: Swyngedouw and Heynen, 2003). A major focal point for political ecologists is the complex role of 'justice-nature-society' relations in the making and contesting of urban transitions. Scholarship in this area of CUTS emphasizes that, if decarbonization occurs, it will involve and produce new political-ecological dynamics that demand scrutiny. Finally, I examine what I refer to as Marxian approaches to urban development. Marxist geography is central to apprehending the forces behind urban transitions. Emphasizing the inconstant geography of accumulation in the context of neoliberalization and the so-called entrepreneurial

[1] Revolutionary transitions refer to a range of theoretical perspectives, such as Climate Leninism, that support radical wealth redistribution, direct action, and sabotage as a means of pursuing low-carbon transitions (see: Malm, 2020; 2021; Heron & Dean, 2022)

city (see especially: Cox & Mair, 1988; 1991; Harvey, 2001; While, et al., 2004; 2010), Marxian approaches to the question of urban transitions emphasize the role of class dynamics in the formation of projects and possibly ‘fixes’ that might yield a level of decarbonization but only by creating new societal problems.

In Section 2.3, I build on the preceding examination of scholarship in CUTS and introduce further insights from research on urban transitions regarding decarbonizing the city. I use this discussion to identify three areas of inquiry with a view to forming my research questions in Chapter 3. The first area of inquiry relates to the centrality of ‘configuration failures’ in shaping transitions. I expand on work on “transition failures” that “foregrounds the potential and limits of agency” and offers “[a] ‘counterfactual’ from which to test the more optimistic assertions of agency in transitions (Chandrashekeran, 2016, p. 1642).” I demonstrate the need to examine the recurring, generative and open nature of failure in transitions as actors react to and overcome misconfiguration. The second area of inquiry relates to how actors driving the decarbonising city enrol nature in their discourses and practices to mobilise transitions. I argue that the liveliness of configurations can be understood as a material-semiotic assemblage insofar as the emerging geographies of transitions create, and develop from, the social meanings of decarbonisation. The third and final area of inquiry relates to how issues of class, scale, and power shape and reproduce in sustainability transitions. I argue that not enough literature in CUTS examines the class dynamics of transitions. A focus on neoliberalism and capitalist restructuring suggests failure should be expected given the absence, incongruity, and limits of path creation. At issue is how the gains and losses of success and failure are inscribed in the emerging geographies of the transition. Finally, in Section 2.4, I conclude the chapter before moving on to Chapter 3, where I introduce my research questions and investigative method.

2.2 Critical urban transition studies

The following sub-sections examine three areas of CUTS. In 2.2.1, I examine scholarship informed by the multi-level perspective. In 2.2.2, I examine urban political ecology. Finally, I examine Marxian contributions to CUTS in 2.2.3.

2.2.1 Studies engaging the multi-level perspective

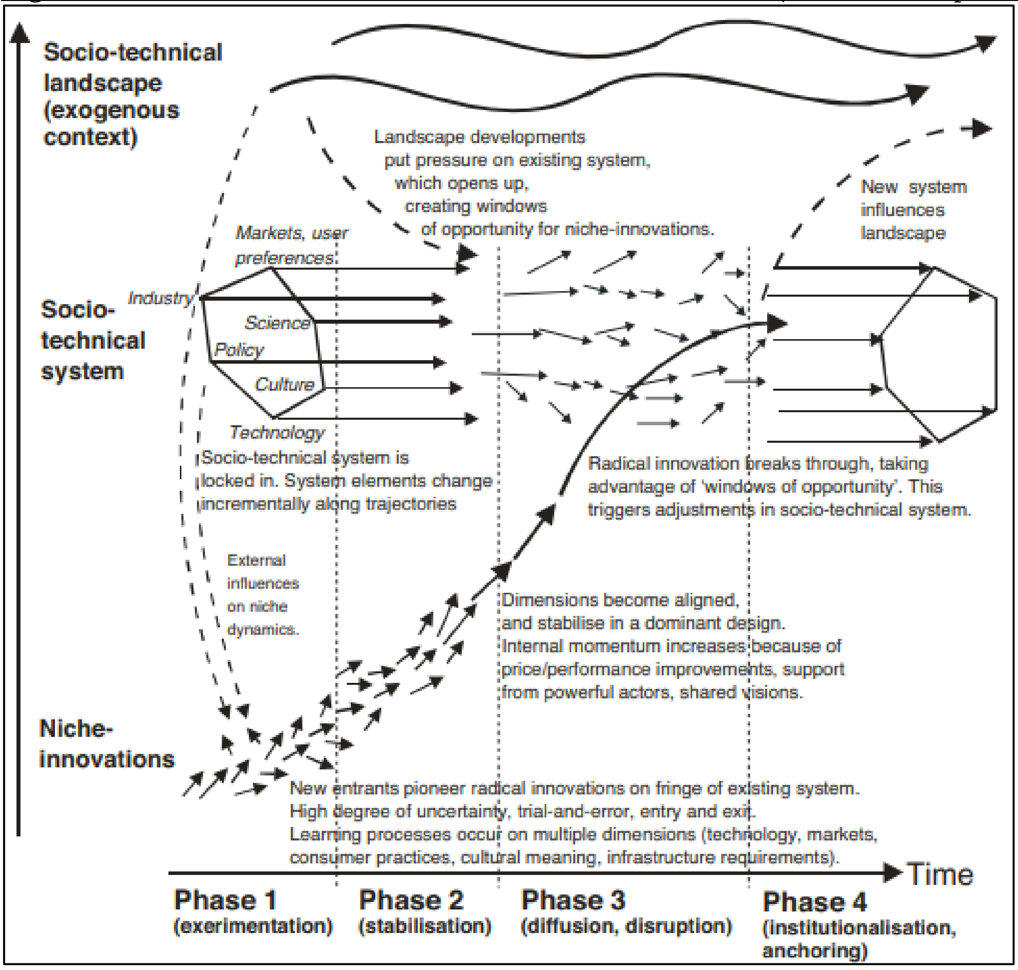
The multi-level perspective is a prominent transition studies framework that seeks to explain the "core analytical puzzle [in transition studies] namely stability and change (Geels, 2012, p. 472)." On the one hand, urban systems such as transport are marked by lock-in and path dependency. There is stability and autopoiesis.[2] On the other hand, path advocates such as pioneers, social movements, and entrepreneurs pursue alternative innovations that can destabilize existing systems and shift them towards desirable technologies for a more sustainable society (Gailing & Moss, 2016; Geels, 2012, Markard, et al., 2012). Hence, as Lawhon and Murphy (2012, p. 357) note, "transitions – or system innovations – occur when there is a disruption in the system that results in a new 'architecture' or system structure." What the multi-level perspective seeks to reveal is the 'disruptive interplay' between (dynamic) stability and (radical) change in socio-technical systems (Geels, 2012).

According to the MLP, socio-technical transitions are configured across three 'levels': niche innovations, socio-technical regimes, and socio-technical landscape (as depicted in Fig 2.1 [from Geels 2019 p. 191]). The first level, niche innovations, is "the key unit of analysis" (Lawhon & Murphy, 2012, p. 358) in the multi-level perspective because of their role in developing new practices, codes, and norms. Niche innovations occur when "new technologies are protected [and are] provided with space to grow and mature through gradual experimentation and learning processes performed by producers, researchers, users, as well as governmental and other organizations" (Lopolito, et al., 2011, p. 28). The

[2] For example, Urry (2004) conceptualises the automobility system as a self-reproducing and self-organising autopoietic or a system that generates the preconditions for its own lock-in and self-expansion.

‘protective spaces’ take the form of R&D laboratories, subsidised experiments, ‘regulatory sandboxes’, or market niches where a userbase is willing to support the diffusion of the technology (Geels, 2012). Niches provide actors with the room to strategically develop networks, build a consensus in the early implementation of the technologies, and diffuse the necessary information to evolve the technology base (Hermans, et al., 2013; Geels, 2012).

Figure 2.1. The MLP on socio-technical transitions. Source: (Geels, 2019. p. 191)



The second level is the socio-technical regime, which refers to the incumbent system that appears as a stable structure and selection environment for innovations that niche-level actors seek to alter or replace. According to Rohracher and Spath (2014, p. 1417), “the regime level incorporates the mutually reinforcing technological and institutional structures of specific domains… and is characterised by a resistance to change (which, for example, may cause promising new technologies to fail).” An example is transport regimes that rely upon the self-organising nature of private automobiles.[3] The third and final level is the socio-technical landscape which refers to exogenous developments or shocks that “…create windows of opportunity for the diffusion of niche innovations (Sovacool & Brisbois, 2019, p. 4),” and include the shifting dynamics of political ideologies, social codes and norms, the media, macro-economic trends, hostile conflicts, and climate catastrophes (Geels, 2012, p. 473).

The empirical focal points in MLP research tend to be transitions that take several decades or more; indeed, according to Lawhon and Murphy (2012, p. 357), “some are never complete.” As such, time is a crucial consideration, which the MLP framework differentiates into four phases: experimentation, stabilization, diffusion and disruption and anchoring (again as depicted in Fig 2.1 [from Geels 2019 p. 191]). Experimentation involves trial and error learning in protected spaces and is characterized by “much uncertainty, competing claims and promises, and high rates of failure and pioneer burnout” (Geels, 2019, p. 190). Stabilization sees innovations gaining traction in a niche market where technologies begin to see a degree of stability around design, standards, specifications, and practices. Diffusion and disruption entail innovations expanding to mainstream markets driven by niche-internal drivers like price/performance improvements, economies of scale, development of complementary technology, support by powerful actors, and taking advantage of apparent windows of opportunity from landscape pressures on regimes. Finally, there is the anchoring phase, which is characterized by struggles between incumbent regimes and niche innovation while new socio-technical systems replace, at least in part, the old and become normalized in the mode of regulation.

---

[3] Urry (2004) argues that the automobile has six mutually reinforcing components: as a manufactured object (e.g., leading industrial sectors of the 21st century), of individual consumption (e.g., a status symbol), its interlinkages (e.g., petrol refining, suburban house building, car sales), it’s mobile dominance (e.g., road infrastructures subordinating active travel), it’s cultural dominance (e.g., significance in film, poetry and music), environmental resource-use (e.g., pollution, minerals extraction).

In short, niches consist of nascent eco-innovations that build up momentum through protected spaces and struggle against existing regimes in efforts that alter or transform the system. Socio-technical regimes are social relations that constitute an incumbent system in the everyday, such as transport systems. Socio-technical landscapes are wider contexts that appear exogenous to the regime but create pressures that can destabilize the regime. Thus, everyday regimes, while appearing stable, experience pressure from the niche below and the landscape above in abstract terms. According to Geels (2014), the dynamic interplay of action at each level can destabilize regimes in such ways as to create windows of opportunity for the diffusion of niche innovations within the regime (see also: Sovacool & Brisbois, 2019).

Although Figure 2.1. does not explicitly show actors, the MLP brings agency into focus because the trajectories and levels are enacted by social groups. Geels (2011, p. 29) argues that “the different structural levels are continuously reproduced and enacted by actors in concrete activities [and trajectories]” that develop in a manner “similar to Karnøe and Garud’s (2011, p. 3) view on path creation”: [Geels citing Karnøe and Garud] “By stressing path creation, we draw attention to phenomena in the making, that is, the temporal processes that underlie the constitution of phenomena. Such a perspective assumes reciprocal interactions between economic, technical, and institutional forces that constitute technological artifacts and actors involved. Thus, social orders, institutional orders, and artifacts are both the medium and outcome of human endeavors.”

Given this emphasis on agency, the MLP invites an analysis of the differential actions that constitute niche innovations. Geels (2019), for example, suggests niche innovations can include radical technical innovation (e.g., hydrogen cars), grassroots and social innovation (e.g., bike clubs), business model innovation (e.g., car sharing), and infrastructural innovation (e.g., high speed rail systems). Schot, et al. (2016) go further by classifying niche innovation users in five ways. There are, first, user-producers (or users-turned-entrepreneurs) who “invent, experiment, and tinker with radical technologies, creating new technical and organizational solutions, articulating new user preferences and enabling new routines to emerge (Schot, et al., 2016, p. 4).” Second, there are ‘user-legitimators’ who develop the meanings and contexts of the technology to develop the innovation. Third, there are ‘user-intermediaries’ who help upscale and popularise niches by aligning elements of the socio-technical system and providing spaces for the technology to develop new user representations. Fourth, there are ‘user-citizens’ who engage in regime-shift politics and lobby governments and other regime actors to give preference to a particular technology. Finally, there are ‘user-consumers’ who “express their status and identity by attributing symbolic meanings to new technologies” (Schot, et al., 2016, p. 5).

My focus is not on recategorizing niche innovation groups; rather, my point is these typologies demonstrate the diverse nature of early adopter experiences and the wide range of actions required to develop niche innovations. Enacting transitions entails costs, burdens, and struggles; there are power dynamics within transitions that invite a focus on the role of powerful actors and so-called elites in reproducing and entrenching inequalities (Sovacool & Brisbois, 2019). In the context of neoliberalism, moreover, transitions emerging from efforts to decarbonize the city are supposed to occur from the ground because states have devolved responsibility to entrepreneurs and consumers. Thus, and as I will discuss in Section 2.3, the uneven and unequal experiences of consumers demand attention because they shape the process of decarbonizing the city. Likewise, understanding whatever is happening at the niche level requires grappling with failures regarding the configuration of the materials and practices that hinder the enactment of urban transitions. With respect to the field of CUTS, what the MLP emphasizes is the role of mundane and obscure actions regarding socio-technical innovations in urban transitions. There is a constant interplay characterized by struggle between different agents who compete, push, pull and prompt each other.

A final crucial element of scholarship engaging the MLP relates to the framework’s blindspots. Some critical scholars have taken aim at how social relations are examined in the framework, pointing to its "spatial blindness" (Becker, et al., 2016, p. 94) and lack of account of power and politics (Lawhon & Murphy, 2012). Furthermore, at the core of the MLP is the belief that capitalist competition can drive motors of innovation in ways that make it possible to decarbonize. There have been reappraisals of this position. For example, Kivimaa and Kern (2016) argue that more attention needs to be paid to regime destruction and deliberate destabilization of fossil-based systems, arguing "that while the cumulative build-up of various innovation system functions […] is necessary, on its own it is insufficient to drive significant sustainability transitions, especially given the urgency of the required transitions. Therefore, the cumulative effects and dynamics of both niche support and regime destruction processes should be at the centre of attention." However, scholarship utilizing the MLP is typically supportive of entrepreneurial efforts to decarbonise, which stands in contrast to more antagonistic views that bring into question the ability of capitalism to solve the decarbonisation puzzle [such as the fields I discuss in 2.2.2 and 2.2.3]. Moreover, how social and environmental objectives are coopted in ways that reproduce social inequality is a point severely neglected by scholarship engaging the MLP. Therefore, while the MLP invites an analysis of the dynamic interplay of relations that configure transitions, closer attention needs to be paid to the logic and limits of capital accumulation in enabling or hindering transitions.

2.2.2 Political ecology on urban transitions

In the previous sub-section, I focused on work engaging with the multi-level perspective, a transition framework that draws attention to the interplay between actors who drive eco-innovation niches in efforts against incumbent regimes. In this sub-section, I consider the contribution of political ecology to critical urban transition studies.

Political ecology is "firmly established as an important area of inquiry within Geography" (Elmhirst, 2011, p. 129). Although it is "pluralistic in its conceptual moorings" (Elmhirst, 2011, p. 129), it aims, at the minimum, to understand "the complex relations between nature and society through a careful analysis of [...]

access and control over resources and their implications for environmental health and sustainable livelihoods" (Watts, 2000, p. 257). Elmhirst (2011, p. 129) suggests that political ecology can "direct attention towards many of the most important questions of our age: poverty, social justice, the politics of environmental degradation and conservation, the neoliberalisation of nature and ongoing rounds of accumulation, enclosure and dispossession." Beyond a simple emphasis on the role of nature in transitions, political ecologists hold that ecological and political-economic change are co-produced through what Neumann (2009, p. 228) refers to as a "nature-society dialectic." As Lipietz (1996, p. 222) describes the field: "political ecology is thus a *relation of each to all others,* in their common relation to the environment, which is both the product and the precondition of any activity." In the context of my work, political ecology directs attention to the justice-nature-society relations that underpin transitions in order to answer Swyngedouw and Heynen's (2003, p. 901) call to "consider the question of who gains and who pays and to ask serious questions about the multiple power relations – and the scalar geometry of these relations – through which deeply unjust socio-environmental conditions are produced and maintained."

One highly influential concept in political ecology is the notion of 'just transition', an issue of particular interest among scholars in the field of CUTS. A focus on 'just transition' has emerged in analyses of the debates and practices regarding the decarbonization of society. What is meant by transition and what is meant by justice, according to Newell and Mulvaney (2013, p. 132), is often framed against the backdrop of "those currently without access to reliable energy supplies and living in energy poverty and to those whose livelihoods are affected by and dependent on a fossil fuel economy." Although this framing of just transition can capture some of the economic fallout of decarbonisation, it risks neglecting vital questions in transitions about what Swyngedouw & Heynen (2003, p 907) describe as "the (changing) dependence of capital accumulation on nature." By examining the core features of political ecology, I aim to tease apart the intimate relationship between justice, transition, and accumulation and the tensions therein.

At the urban level, work from within the sub-field of *urban* political ecology (UPE) can help emphasize the socio-ecological processes at work that enable or hinder the ability of just transition to develop. According to Swyngedouw and Heynen (2003), UPE scholarship approaches the city as “a palimpsest of densely layered bodily, local, national and global – but depressingly uneven geographically – socio-ecological processes (p. 899).” Angelo and Wachsmuth (2014) argue that the subfield has had two major impacts on critical urban studies. The first was to spark critical perspectives on the ecology of cities as sites where efforts to understand the natural were often neglected. As they suggest, “…[the city] is a site where nature was understood to be already subjugated to society – where no rehabilitation was possible because there was no ‘environment’ left to be rehabilitated (p. 17).” The second impact refers to the utility of UPE in providing a framework to help retheorize “… the city as a product of metabolic processes of socio-natural transformation” (Angelo & Wachsmuth, 2014, p. 16). Urban metabolism, according to Swyngedouw & Heynen (2003, p. 906), refers to the “interwoven knots of social process, material metabolism and spatial form that go into the formation of contemporary urban socio-natural landscapes.” The notion of metabolism shifts the understanding of space as abstract and static (e.g., considering criticisms of the MLP) towards a conceptualization that can account for the interplay and motion of nature-society relations involved in the production of space. The concept draws from Marx’s (1976) understanding of the intimate metabolic relations between humans and nature:

> Labour is, first of all, a process between man and nature, a process by which man, through his own actions, mediates, regulates, and controls the metabolism between himself and nature. He confronts the materials of nature as a force of nature. He sets in motion the natural forces which belong to his own body, his arms, legs, head, and hands, in order to appropriate the materials of nature in a form adapted to his own needs. Through this movement he acts upon external nature and changes it, and in this way he simultaneously changes his own nature… (Labouring) is the purposeful activity aimed at the

> production of use-values. It is an appropriation of what exists in nature for the requirements of man. It is the universal condition for the metabolic interaction between man and nature, the ever-lasting nature-imposed condition of human existence, and it is therefore independent of every form of that existence, or rather it is common to all forms of society in which human beings live (pp. 283, 290).

One way to apprehend urban metabolisms in action is through the formation of what Bridge and Gailing (2020) refer to as 'new energy spaces.' New here means "the production of novel combinations of energy systems and social relations across space – that is, a process of uneven development – rather than an interest in only certain energy technologies" (Bridge & Gailing, 2020, p. 1038). This uneven development in world ecologies suggests that the emergent geographies of transition need to be contextualised in planetary ways – that is, as a product of spatially extensive, messy, and unequal webs and flows of socio-natural resources. At the same time, new energy spaces point to the relevance of localized agents and spaces. A helpful prompt in this regard is to dwell on what Hodson and Marvin (2010, p. 299) refer to as "premium ecological enclaves", which refers to the promotion of new forms of ecological urbanism that reshape and redirect resources in cities towards bounded and divisible geographies for the consumption of elites. They argue that "ecologically secure premium enclaves [can]… by-pass existing infrastructure and build internalized ecological resource flows that attempt to guarantee strategic protection and further economic reproduction."

Consider, for example, Aronoff, et al.'s (2019 p. 83) argument that forms of ecological urbanism such as 'grid defection' in the US primarily benefit wealthier communities who pursue solar energy arrangements that maximise independence from the grid, creating what they describe as "resource-intensive solar separatism for the rich and the geographically lucky." In fact, the emergence of new energy spaces possibly will entail new forms of enclosure, dispossession, and struggle as industries remove and commodify socio-natural resources from ecologies to sell on the market (e.g., conflicts over mineral extraction in well-to-wheel pipelines).

Riofrancos (2019; 2020) and Arboleda (2020), shed light on 'what green costs' by highlighting how the push for battery storage creates new 'sacrifice zones' characterized by socio-natural conflict and degradation in the global south (e.g., drought and conflict related to lithium extraction in the Andes region). Moreover, Bresnihan and Brodie's (2020) analysis of the interconnections between wind and data firms in driving new distributed networks of enclosure across rural Ireland illustrates that new rounds of extractivism are emerging in the global north. Such developments are akin to a socio-ecological fix, which, borrowing from Harvey's notion of the spatial fix (which I examine further in subsection 2.2.3), suggests that capitalism can temporarily displace crises "through and around ecological processes and landscapes, which themselves are always socio-natural in character" (Ekers & Prudham, 2015, p. 2439). For example, renewable energy regimes help displace part of the crises of climate change and peak oil by "enrolling new elements of non-human nature into circuits of capital" (McCarthy, 2015, p. 2485). As such, it pays to examine how the rolling out of new energy spaces across the city can enroll nature to displace crises and how individuals, firms, and governments are all caught up in the action.

None of this is to suggest that new energy spaces are destined to drive inequality. For example, Brown et al.'s (2012) work on the transition towns movement in the UK (a movement that implements transition models around niche innovations) suggests a radical reading of the movement's tenets on shared resources, lower consumption, energy resilience, and collective action "might help rupture our alienated obsession with the consumption of commodities and be part of a 'crack' in the system of capitalism (Brown, et al., 2012, p. 1618)." Therefore, the creation of new energy spaces can permit visions of what Huber (2021) calls 'the case for socialist modernism' in which he argues that "the socialist task today is not only to seize the means of production for human liberation, but also species survival. This would entail restructuring industrial systems to keep the labor saving aspects but discard the ecologically destructive aspects (Huber, 2021, p. 2)." Thus, on the one hand, new energy spaces open up visions for post-capitalist alternatives built on labour saving technologies. Yet, on the other hand, CUTS must be sensitive to efforts by individuals, firms, and governments who push to limit the promise of such futures to materialize. The above cases illustrate the importance of analyzing what Swyngedouw & Heynen (2003, p. 911) describe as "a series of enabling (for powerful individuals and groups) and disabling (for marginalised individuals and groups) social and environmental conditions [in transitions]." What's required, then, are in-depth empirical case studies of specific transitions to help analyse the social, material, and discursive contexts of new energy spaces as they emerge across cities.

In summary, I argue here that political ecology invites scholars to consider how nature-society relations are interwoven across space through urban infrastructure, capital, and struggle. As Arboleda (2020, p. 110) points out, "throughout modern history, spaces of primary-commodity production [and consumption] have been entangled in dense webs of connectivity that meld together with distant geographies." Therefore, CUTS must be attuned to the planetary webs and flows that underpin transitions and also acknowledge how these dynamics are driven by the activity of localized agents in new energy spaces across cities. Crucially, political ecology can help to disentangle and articulate the changing metabolisms of human and non-human life, how they relate to economic growth, and produce novel power relations and struggles under decarbonisation. My work treats the role of eco-tech users, entrepreneurs, and other advocates as a conduit into questions of socio-natural transformation and how their activities intimately relate to the emergent geographies, the socio-technical configurations, of transitions in complex and messy ways.

2.2.3 Marxian approaches to urban development

In the previous sub-section, I focused on work in political ecology that can contribute to critical urban transition studies. In this sub-section, I focus on the Marxian contributions to CUTS. First, I consider the relationship between Marxian thinking and transitions. Second, I examine interconnections with neoliberalization, the state, and capitalist development. Third, I discuss Marxian critiques of the entrepreneurial city and the specific role of 'eco-state restructuring'. Finally, I examine the dynamic interplay between regimes of accumulation and modes of social regulation that might enable or constrain the ability of transitions to develop.

The notion of 'transition' has appeared in Marxian analysis from the outset. A standout example is in debates surrounding 'the period of transition'[4] from capitalism to communism in which, according to Dauvé (2016, p. 9), workers are expected to "seize control of the political (Leninist) or economic (syndicalist) apparatuses and run them in their own interests." Likewise, transition appears in Marx's interest in critical junctures and social change, for example, in Marx & Engels (1998, p. 93) interest in "the transition from the old world to the feudal system" or in Marx (1976, p. 507) suggesting "the economic structure of capitalist society has grown out of the economic structure of feudal society." Transitions, in terms of large-scale shifts or watershed periods in social relations, are central facets of Marxian analysis.

Marxism has been a highly influential school of thought in human geography. According to Cumbers (2009, p. 461), "the adoption of Marxism as a theoretical perspective and a political project in the 1970s was the single most important development in the evolution of a critical human geography." While its contributions have been vast, there are some overriding concepts relating to the geographic restructuring of capitalism that I dwell on that are relevant to transition scholarship. The first relates to David Harvey's (2014) notion of the spatial fix in which he argues that in order to resolve problems of overaccumulation in one place, capitalist expansion must fix capital in another space, for example, by embedding new infrastructure, establishing new centres of accumulation, and

[4] Debates around the 'period of transition' have a rich history of problematising socialist transitions in ways that can enrich discussions on low-carbon transitions. For example, Dauve's argument that historically periods of transition towards socialist alternatives were "counter-revolutionary" because they "entailed a power structure that would resist "withering away" (e.g., anarchist critiques of the dictatorship of the proletariat) or that they "seemed to leave unchallenged fundamental aspects of the relations of production (p.7)." In response, Dauve argues for communisation which refers to "the application of communist measures" within periods of transition themselves.

forming social dependencies on those structures. The creation of new loci of accumulation, however, threatens "the values already fixed in place elsewhere" (Harvey, 2014, p. 152) because as capital circulates from place to place, it devalues former or excluded loci of accumulation. Yet, as a central contradiction in the geographic expansion of capitalism, capital cannot stay put because then its surplus cannot be deployed profitably. As Harvey (1982, p. 391) suggests, "location is an active moment within the overall circulation and accumulation of capital."

Along similar lines, Cox and Mair (1991; 1988) zero in on the dependencies emerging from this fixity and mobility interplay. Their interest is in the role of localized agents and structures in protecting and fostering accumulation for the benefit of their own milieu, therefore helping specific activities and value from production to "congeal in forms which are either absolutely fixed in space… or relatively fixed in space" (Cox & Mair, 1991, p. 396). Grappling with these dynamics requires "a conceptual framework which does not lose sight of the reciprocal relationship between localised and wider social processes… and yet is also able to incorporate the role of the individual actor" (Cox and Mair, 1991, p. 394). One key element in such a framework is the second concept I wish to dwell on, "local dependence", which arises when capital is relatively fixed in a locality and becomes dependent on the continuation and expansion of economic activity. Local dependence matters as a result of capital's inevitable mobility, which exerts stress on economic actors such as firms, institutions, and individuals and compels them to defend their investments, for example, via scalar activity to produce political or economic action. In other words, what takes shape, as While, et al. (2004, p. 551) might have put it "[is that] the geographical reproduction of the capitalist mode of production depends on uniting territorially-based class interests and factions behind a coherent line of action (or state strategy) in the form of a 'spatial fix', which is capable of holding for a time, though not necessarily resolving, tensions between capital and labour, and economic development and collective consumption."

With respect to CUTS, local dependence invites an analysis of two key issues for my research. First, capital's locality-specific alignment around the fixity-mobility contradiction points to the need to analyse class relation in action as economic actors are compelled to create pathways in sustainability transitions that draw in the necessary resources and protections for their investments. The actions of economic actors, therefore, are crucial as they prompt, push and pull others as they lobby and boost political campaigns aimed at promoting greener living but also in the specific lived experience of individuals who champion, promote, govern, and use decarbonising technologies to attract investment (e.g., car club members lobbying for better infrastructure). Accordingly, the "lively practices' (Morris, 2016; see also Harris, 2020) of decarbonizing action – the market interactions and performativities of individuals and their narratives – draw attention to new engagements with local dependence.

Second, local dependence invites an analysis of scale in terms of what Cox and Mair (1991) refer to as 'locality as localised social structure and locality as agent.' Locality as a social structure refers to "a set of social relations at a particular spatial scale, within which concrete interests are defined (Cox & Mair, 1991, p. 197)." – for example, in how political and economic actors pursue localised decarbonisation strategies. Locality as agent refers to how "people interpret localised social structures in explicitly territorial terms, come to view their interests and identities as 'local', and then act upon that view by mobilising locally defined organizations to further their interests in a manner that would not be possible were they to act separately (p. 198)." The local scale, however, always emerges against the backdrop of the non-local and variegated scales of political and economic action. Whether it's national, regional, or global, localities can draw upon and contest different scales to mobilize transitions.

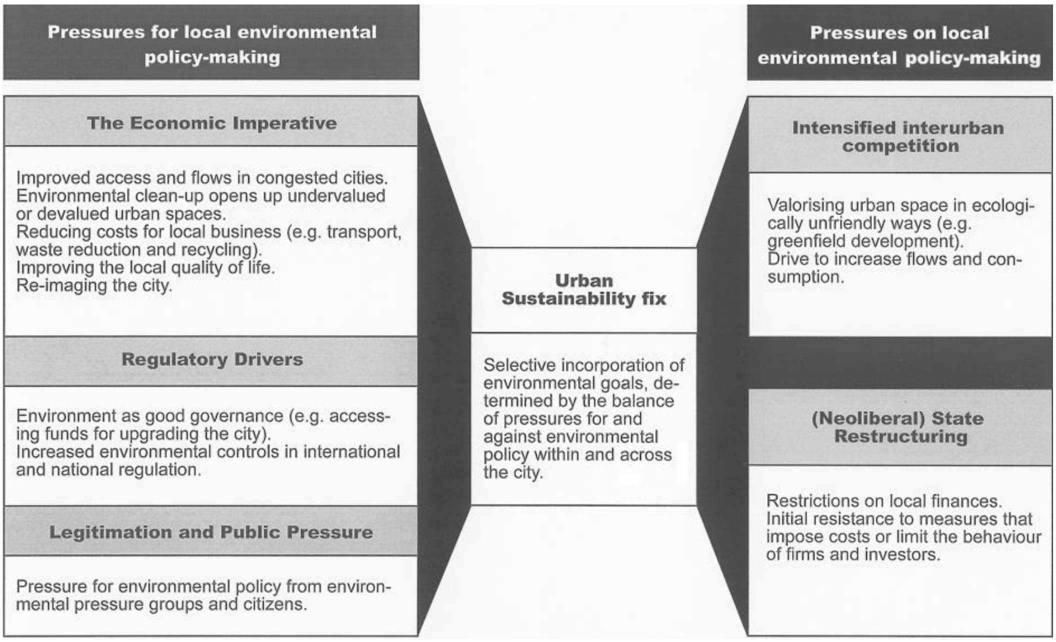
To move towards an understanding of the complex and variegated character of scale, I argue CUTS should look to the so-called 'neoliberal turn,' which has taken shape since the 1970s (see: Harvey, 2005; Peck, et al., 2018; Jessop, 2002). According to Harvey (2005, p. 2), "neoliberalism is in the first instance a theory of political economic practice that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedoms and skills within an institutional framework characterized by strong private property rights, free markets, and free trade." Harvey (2005, p. 64) suggests, the role of the state in neoliberal theory is easy to define but "the practice of neoliberalization has, however, evolved in such a way as to depart significantly from the template that theory provides." One way it departs, according to Jessop (2008, p. 196) is through the rescaling of the state "upwards, downwards and sideways" as state power and authority is displaced and destabilized by the growth of supranational institutions from above and devolution and decentralization of powers to sub-national institutions from below. Another way the neoliberal state departs from theory is in its "forms and degrees" of neoliberalism (Jessop, 2002, p. 458). Brenner, et al. (2010) suggest neoliberalization is variegated and processual; appearing in waves of restructuring since the 1970s with its character moulded through place-specific conditions. As Peck and Theodore (2019, p. 247) suggest, the process is "in an ongoing state of contested reconstruction" and "its reactionary face always being consumed (if not defined) by context-specific struggles, rollbacks, and flawed experiments."

With regards to CUTS, then, the neoliberal project of "growth first" needs to be seen as a driving force behind the push for new forms of "green accumulation" and associated regulatory shifts that can enable (but also constrain) decarbonisation. Given the variegated character of neoliberalization, which Brenner and Theodore (2002) argue requires examinations of "actually existing neoliberalism," a core issue for CUTS is attending to the contextual embeddedness of neoliberal restructuring and how it is configured as part of what Jessop (2002, p. 453) describes as, "a repertoire of Western, economic, political and ideological discourse… with elements from other discourses, strategies, and organizational patterns." A focus on neoliberalism in transitions invites scholars to engage with state-capital configurations, power dynamics, and structures in terms of what Smith (2002, p. 429) describes as "… the mobilization not just of state power but of state power organized and exercised at different geographical scales."

A key concept that can help give coherence to the state's role, neoliberalism, and capitalism in transitions is the so-called "entrepreneurial city" (see: Lauermann, 2018; While, et al., 2004). The entrepreneurial city concept emerged from Harvey's (1989) insights on the emergence of new urban governance strategies (e.g., public-private partnerships, inter-urban competition, municipal speculation) employed by public and private coalitions to grow local economies. The entrepreneurial city, according to While et al. (2004, p. 549), is "inextricably linked to the rolling back of national state regulation, the cutting loose of localities from centralized fiscal resources and controls, and the triumph of a neoliberal 'growth first' ideology" (See also: Peck & Tickell, 2002). Lauermann (2018, pp. 205) argues that, despite recurring crises and mutations in the form of austerity, new forms of financialization, and diverse experiments in urban policy, "practices of entrepreneurialism remain resilient." He, therefore, argues that "there is a pressing need to trace how alternative urban politics operate alongside the growth politics of the contemporary entrepreneurial city" (Lauermann, 2018, p. 219).

One fundamental shift in urban politics surrounds what While et al. (2010) describe as 'urban sustainability fixes' and 'eco-state restructuring' (ESR). In their work on Manchester and Leeds, ongoing and unfolding restructuring of the state in relation to environmental politics is understood as a green version of practices found in the classic entrepreneurial city. While et al argue it is possible to consider "superficially the neoliberal project of 'growth first' seems to conflict ideologically and materially with the principles and practices of urban sustainability; that is, notions of ecological limits, intra- and intergenerational equity, the integration of economic, social and environmental priorities, and widening involvement in decision-making" (2004, p. 550). However, they argue governments can temporarily resolve some tensions by pursuing a relatively coherent line of action through an "urban sustainability fix," which they describe as "the selective incorporation of ecological goals in greening urban governance… (that) draws attention to the particular dilemmas urban regimes in different cities currently face in balancing economic, social and environmental demands" (While, et al., 2004, p. 551). Figure 2.2 charts some economic, social, and environmental demands that urban regimes face related to the urban sustainability fix. In the left column, the authors consider pressures *for* local environmental policymaking, and in the right column, the authors consider pressures *on* local environmental policymaking. One caveat here is the extent to which While et al. (2004, p. 551) may overemphasize the "balancing economic, social and environmental demands" as opposing forces and ignore the ways social and environmental objectives are completely subsumed, internalized, and distorted within capitalist regimes of accumulation.

Figure 2.2 The Urban Sustainability fix. Source: (While, et al., 2004, p. 552)



In the context of looming decarbonisation targets, Marxian approaches to CUTS must anticipate an intensification of the incorporation of ecological goals. The response to that intensification raises vital questions about the configuration of strategies and coalitions around green growth and deep eco-state restructuring.

All of this is to say that the emergence of the geographies of the transition is not determined by dynamics of capital but rather that a focus on capitalist accumulation, on the geography of capitalism, signposts the extent to which, and the ways in which, urban transitions are capitalist projects. As Jessop (2009, p. 22) suggests, the geographies of capitalist accumulation are marked by multiplicity (e.g., accumulation is multicentric, multi-scalar, multitemporal, multicausal and multiform) or what Storper and Walker (1989) might refer to as "capital's inconstant geography." Therefore, just as a Marxian approach to transitions requires conceptualizing watershed periods in social change, it also calls attention to the obscure and variegated order of such change. In short, a Marxian approach to transitions invites a critical engagement with the role of capitalist development. Marxian approaches to CUTS raise questions about the relationship between space, capital, and the neoliberal state in shaping transitions to a low-carbon society. As While et al (2004, p. 550) suggest, what becomes crucial in energy transitions "… is how the balance of state power and competencies, pressures and incentives variously enable and constrains urban environmental policies in different national urban contexts." I argue that CUTS must ask how growth coalitions of public and private sector actors decarbonise cities by configuring actions and relationships; by generating new spatial dynamics of green accumulation in inter- and intra-urban contexts; by boosting projects via specific discourses and governmental practices; and by efforts from early adopters to champion and exploit decarbonising technologies for their own purposes.

2.3 Developing Critical Urban Transition Studies

In Section 2.2, I examined the contributions of the multi-level perspective, urban political ecology, and Marxian approaches to critical urban transition studies. In this section, I synthesize key aspects from the three fields with a view to developing CUTS. Building on my research regarding connected but often competing efforts to decarbonize the city in Dublin, specifically aspects of its transportation sector, I make three conceptual moves. The first is to build on the MLP to focus on the existence, role, and impact of what I refer to as 'configuration failures' within urban transitions. The second is to build on urban political ecology by asking about the obscure yet central role of nature's enrolment in urban transitions. The third and final move is to emphasize the need for a type of analysis that examines class, scale, and power in urban transitions. In each of the subsequent sub-sections, I discuss these moves via reference to actions in Dublin, as well as other cities. The aim is to demonstrate the scope that exists to conduct research that can inform CUTS in novel ways.

2.3.1 On the centrality of 'configuration failures'

According to the Irish government's Climate Action Plan, transitions require "that both the people and systems are configured to deliver on climate action" (Department of the Environment, Climate and Communications, 2021, p. 35). In this sub-section, I draw upon approaches engaging the multi-level perspective to focus on socio-technical configurations (e.g., charging points, suppliers, cables, knowledge, infrastructure). As previously outlined, the multi-level perspective approaches transition through the dynamic interplay of technology users and political and economic actors who struggle to give rise to new socio-technical regimes. I am concerned with the highly differentiated and complex processes at work that define and permit socio-technical configurations to hang together in Dublin. I draw from Evans, et al (2016, p. 10) and pay "…attention both to the micro-scale social and political practices, impacts, and implications of experimentation (niches), as well as to the larger-scale networks and policies that sustain them…" in order to ask how coherence emerges in urban transitions.

In the first instance, the MLP tells us that the role and experience of consumers matter. Consider how consumers express agency to adopt, manage, and govern technologies as central to the project of decarbonising the city. If consumers fail to configure technologies along with assemblages of personal and shared technologies, if the technology fails to enable users to interact with and produce the city in desired ways, the decarbonising project fails. In the context of microscale analysis, science and technology studies (STS), especially assemblage theory, also places an emphasis on the configuration of people, things, and discourses.[5] The task is to shed light on the way entanglements are created, used,

[5] See also: Foucault's (1989, p. xxi) on the relationship between discourse and configurations in his work on "the order of things" in which he highlights how knowledge representing the relationship between people and things is made obscure and taken-for-granted through their material-semiotic configuration. As he argues, "order is… that which is given in things as their

and broken in everyday practices. According to McFarlane and Anderson (2011, p. 162), configuration in this sense "appears as a specific form of relational thinking that attends to the agency of wholes and parts, not one or the other." The point here is to focus on socio-technical configurations for the sake of drawing attention to society-technology interplays at the microscale. As niche innovation users interact with the spaces of emerging socio-technical systems, the question is how emergent relationality forms the building blocks for transitions.

At the same time, socio-technical configurations demand we pay attention to the multi-scalar character of configuration. Consider the role of path creation in socio-technical configuration. 'Path creation', is what MacKinnon et al. (2019) suggest is at issue when coalitions of public and private sector actors envision and push to achieve societal change. Path creation frameworks seek to uncover factors that initiate, inhibit, or consolidate relations that shape economic activity and social reproduction (MacKinnon, et al., 2019; Kogler, 2019). The multi-level perspective implies that path creation can and does drive transitions (see: Geels, 2011; Upham, et al., 2014). However, there is a pressing need to analyse how such development relies upon relations, legacies, and conditions in a wide range of national, regional, and local contexts. Even as socio-technical configurations take shape at the microscale, path creation points to the need to examine wider public-private policy creation, institutional mixes, and diverging strategies at various scales. The question here is how they become grounded in specific socio-technical arrangements.

I argue for apprehending the dynamics of social-technical configurations through the notion of 'transition failure' (see: Wells & Nieuwenhuis, 2012; Chandrashekeran, 2016; Caprotti, 2016).[6] As Chandrashekeran (2016, p. 1642)

---

inner law, the hidden network that determines the way they confront one another, and also that which has no existence except in the grid created by a glance, an examination, a language; and it is only in the blank spaces of this grid that order manifests itself in depth as though already there, waiting in silence for the moment of its expression."

[6] For example, the recent IEA (2021b) study that followed 605 clean energy start-ups across the globe and suggested "81% of these start-ups probably failed or sold themselves cheaply" for three reasons. First, "venture capitalists did not stay the course as commercialisation timelines

suggests, “a ‘failed transition’ foregrounds the potential and limits of agency, showing how actors operate across difference scales to both transform and reinscribe scalar relations. Greater focus on failure rather than success will help to refine the explanatory variables of transitions providing a useful ‘counterfactual’ from which to test the more optimistic assertions of agency in transitions.” Transition thinkers with an interest in evolutionary economics often advance the concept of ‘hopeful monstrosities’ to refer to macro interventions that, according Schot and Geels (2007, p. 611), “… are hopeful because they promise new technical and functional possibilities… (and) they are monstrous because their early performance characteristics are typically low.” Building on such metaphors, Cugurullo’s (2018) work on “Frankenstein urbanism” examines transition failures in the context of sustainable and eco-city imaginaries. He argues that unsuccessful niche experimentation is “generated by the forced union of different, incompatible elements [because] what are promoted as cohesive settlements shaped by a homogeneous vision of the sustainable city, are actually fragmented cities made of disconnected and often incongruous pieces of urban fabric (p. 73).” The sink-or-swim dynamics of niche innovations as they are rolled out across the city in messy and potentially incongruous ways points to the need to examine failure as a central feature of CUTS.

In the context of Dublin, ‘transition failure’ has been an ongoing theme in the transport sector, particularly in relation to several high-profile projects that have been jettisoned or left idle by the government since the 2008 recession. For example, Dublin’s first metro line has been in the design phase since 2005 despite appearing in successive programmes for governments. According to McDonnell and Caufield (2011, p. 727), these consistent “failures of planning” have had a negative impact on sustainable travel. Moreover, they have led to a situation of “forced car ownership” among Dublin’s urbanites. As late as 2022, the OECD (2022) suggested that Ireland’s car-dependent transport system needed to change,

---

lengthened.” Second, “globally, government policies to support early-stage, riskier technologies took longer than anticipated to be written into legislation.” Third, “some start-ups overpromised and underdelivered.”

suggesting that improvements in fuel efficiency and electric vehicle use will not be enough to meet the state's 2030 climate emission targets.

Yet, scholarship on transition failure has neglected to emphasize the burden, hassle, and constraints set by the presence and effect of configuration failures. Crucially, how actors experience, manage and react to failure matters in anchoring configurations. Consider the work of Graham and Thrift (2007), in which they argue that processes of maintenance and repair form the substrate that allows socio-technical configuration to exist. They argue that "perhaps we should have been looking at breakdown and failure as no longer atypical and therefore only worth addressing if they result in catastrophe and, instead, at break down and failure as the means by which societies learn and learn to reproduce (p. 5)." Failure, then, suggests the need to pay attention to the burden of things going wrong and how that burden is unevenly felt by actors. It also suggests the need to consider how actors *rework* configuration failures by prompting the repair, maintenance or circumvention of issues that emerge from breakdowns, bugs, and glitches.

Urban imaginaries such as the smart city have long been criticised by scholars such as Townsend (2013) for their actually existing 'buggy and brittle' infrastructures. If transitions depend on assemblages of technology, they are also exposed to a buggy and brittle existence. For scholars such as Leszczynski and Elwood (2022; see also Leszczynski, 2020) and Russell (2020) failures and breakdowns present a window of opportunity that opens up space to negotiation, reconfiguration, and diffraction. Again, consider the role of technology users as they confront broken infrastructure or technology; do they attempt to discard or abandon configurations? Do they seek out repairs? Do they draw in alternative technologies to overcome failures? 'Glitch epistemology', as Leszczynski and Elwood (2022) descrbibe it, points to the need to understand the actions people take; the resourcefulness of individuals in constructing coherence when exposed to the misconfigured or buggy and brittle geographies of the transition.

In summary, a multi-level perspective approach to critical urban transition studies hints at the need to examine socio-technical configurations, how they are constituted through multi-scalar relations, and how configurations are reworked and reshaped as actors interact with and produce them across the city. I argue that an emphasis on such dynamics signposts the need to examine configuration failures in transition processes. A focus on configuration failures draws attention to when things go wrong, as well as the uneven experience of obstacles and burdens. At the same time, a focus on failures suggests the need to understand in what ways crashes, bugs, glitches, and breakdowns are generative of the pathways and politics of transitions as actors support transitions by circumventing tensions arising from misconfiguration. Failures can act as a counter factual in critical urban transition studies (Chandrashekeran, 2016, p. 1642). Yet, glitch urbanism (Leszczynski, 2020; Leszczynski & Elwood, 2022) also suggests a conceptualisation that considers failures not so much as exceptional but more as a recurring, generative and open feature of social change.

2.3.2 Enrolling nature

In the previous sub-section, I focused on the need to examine socio-technical (mis)configurations and how they are reworked to shape transitions. In this sub-section, I discuss how nature is enrolled in configurations through the discourses and practices of actors who drive transitions. An urban political ecology approach to CUTS highlights the need to pay attention to the politics of nature in cities by articulating the messy and unequal socio-natural webs and flows that make up urban metabolism. At the urban level, scholarship on UPE, according to Heynen (2014, p. 599), "…has been working, in sum, to articulate urban metabolism as a dynamic process by which new socio-spatial formations, intertwinings of materials, and collaborative enmeshing of social nature emerge and present themselves and are explicitly created through human labor and non-human processes simultaneously." In line with Harvey's (1993, p. 28) claim about New York City that there was "nothing unnatural about [it]," to think about political ecology approaches to transition is to engage in a type of research that treats nature as 'lively' in the production of urban change. Given this, I outline the need to examine how actors enrol nature into urban transitions as they pursue decarbonising agendas. I aim to analyse how actors invoke environmental discourses and narratives to shape transitions and how those scripts relate to how actors exploit and produce nature through their decarbonising action.

A political ecology approach, according to Blaikie & Brookfield (1987, p. 17), directs CUTS towards a research agenda "that is focused on the constantly shifting dialectic between society and land-based resources, and also within classes and groups within society itself." In his thesis on the production of nature, Neil Smith (1984a) argued that industrial capitalism, more than anything else, was responsible for contemporary visions of the shifting dialectic between society and nature. To illustrate his point, Smith divided nature into *first* and *second* nature. First nature is the pristine ideal of the so-called natural world, unspoiled by capitalist activity. Second nature is the form of nature transformed by human activity as it commodifies nature. Both visions are co-constituted within capitalist modes of production, as Smith and O' Keefe (1980, p. 35) argue:

> "…it is not just this "second nature" that is increasingly produced as part of the capitalist mode of production. The "first nature" is also produced. Indeed the "second nature" is no longer produced out of the first nature, but rather the first is produced by and within the confines of the second […] In a quite concrete sense, this process of production transcends the ideal distinction between a first and a second nature. The form of all nature has been altered by human activity, and today this production is accomplished not for the fulfillment of needs in general but for the fulfillment of one particular 'need': profit (Smith and O'Keefe, 1980, p. 35)."

O'Keefe (2020, p 1) argued that scholarship developing on the production of nature thesis missed a fundamental point: "The arguments [...] miss that transition in modes of production was critical to an understanding of what the original authors were analysing." As such, I aim to shed light on the shifting interplay between first and second nature by examining how the "ideal distinction between a first and second nature" is transcended by actors in ways that make particular natures visible and obscure or alienate other natures. In essence, I consider the role of what Rancière (2004, p. 12) calls the distribution of the sensible in transitions or "the system of self-evident facts of sense perception that simultaneously discloses the existence of something in common and the delimitations that define the respective parts and positions within it." In other words, as Tolia-Kelly (2017, p. 127) describes it, "the regime of what is possible and acknowledged: the felt, heard, seen and perceived […] implicated in particular familiar patterns, inclusions and exclusions." My point here is that in transitions, the sensibilities of actors are not only crucial in driving visions of first and second nature, but also actors enrol nature into their practices and discourses in ways that make it both explicit and obscure. For example, this inclusion and exclusion is signposted in academic research on Ireland's transport system where scholarship engages ways to improve the transport sector air quality and reduce CO2 (see: Brady & O'Mahony, 2011; Smith, 2010), yet a focus on energy and resource supply chains and the ecological impact of distant geographies remains remarkably absent from the discussion.

Although society and nature are entangled in complex ways, I argue that the notion of "enrolling nature" is appropriate for examining how nature is made explicit *and* obscure in urban transitions. As McCarthy (2015, p. 2485) argues if the societal shift towards low-carbon systems must "maintain accumulation by *enrolling* new elements of non-human nature into circuits of capital", in the context of urban transitions, it's worth reflecting on how nature is enrolled into new circuits of capital discursively and through the appropriation of nature.[7] Davidson (2021, p. 36) argues the socio-natural should be understood as material-semiotic or as "both biophysical and entangled with ideas" – ranging from the idea that it is acceptable to decrease pollution from human movement using resources from periphery geographies (even at the cost of destroying ecologies in sacrifice zones) to the

[7] McCarthy's analysis focuses on rural energy production regimes. However, as Harvey (2018) emphasises, "[struggles] in the sphere of production […] have to be put in relation to struggles… [at the points of] realisation, distribution, social reproduction, the management of the metabolic relation to nature and the free gifts of culture and nature."

notion that energy efficiency, to use the old maxim, can ‘help care for the planet.’[8] Therefore, I argue it is worth dwelling on the interconnections between (socio-natural) meanings and the materiality of transitions, especially given the lack of evidence in the literature that such a promise has been fulfilled.

One point here is ‘enrolling nature’ includes both the workings of raw materials and points to the need to consider the role of (localised) environments, ecologies, and landscapes in producing the conditions for decarbonisation. Consider, for example, Bresnihan & Brodie’s (2020, p. 1646) argument that, in the context of Ireland, “whether data centres locating in the country is due to the cool climate or wind farms dotting the landscape making use of abundant wind…”, Ireland’s local climate underpins the ‘frontiers’ of sustainability transitions. At the same time, decarbonising technologies are actively involved in making local climates as they alter local landscapes and reduce emissions at the point of consumption. The point here is that transitions are realised and formed in material space, and through material space, they shape and are shaped by the natural world.

Thus, CUTS must be attuned to the social meaning actors attribute and draw from such material relations. Consider here how the production of new energy spaces across cities coincides with the emergence of new flows of material, goods, people; indeed, such nascent geographies are socio-natural, but how do actors understand and give meaning to these spaces, their practices, and actions? A helpful example in the context of decarbonisation is the role of greenwashing, whether that is through the selective incorporation of green strategies in corporate and urban boosterism (see: While, et al., 2004; Harlan, 2021; Andersson & James, 2018) or in the exaggerated claims of purported green technologies (see: Nost & Colven, 2022). Ideas and discourses matter in how transitions are framed and in shaping the ability and willingness of individuals to act. As Smith et al. (2005, p. 1503) suggest, “power becomes a question of the representation of problems (and solutions) and competition over which representations (discourses) constitute

[8] For example, see US-based environmental advocacy group the National Resource Defence Council (2019), which posits, “Want a healthy planet? Put energy efficiency to work.”

reality, or viable alternative realities." A focus on social meanings can go beyond dualities of clean versus dirty energy and can help CUTS interrogate how actors on the ground promote (or do not promote) specific environmental logics and how such logics enmesh with the metabolisms – the practices, politics, and spaces of transitions in messy ways.

In summary, my aim is to build on political ecology approaches to critical urban transition studies by examining the complicated presence of nature as it is enrolled through the discourses and practices of actors in the decarbonising city. Discourses and material relations can be separated analytically but not as a lived experience. Thus, my work builds on political ecology approaches to examine how the ecology of the decarbonising drive is made apparent and hidden, obscure, and explicit simultaneously. The complicated presence of nature matters, as Harvey (1993, p. 2) suggests, "the contemporary battleground over words like 'nature' and 'environment' is more than a matter of mere semantics, but a leading edge of political conflict." A political ecology approach to transitions must engage with the power dynamics of the obscure and explicit enrolling of nature. It prompts researchers to consider how nature is invoked to anchor accumulation in transitions and how certain natures are obscured and marginalized by the dominant social order that makes it, as Rancière (2010, p. 36) might describe it, "the part of those who have no part." Rancière (2010, p. 37) suggests that it has a "slogan": "Move along! There's nothing to see here ... here, on this street, there's nothing to see and so nothing to do but move along."

2.3.3 Class, scale, power

In the previous sub-section, I argued for examining how nature is enrolled in configurations through the discourses and practices of actors who drive decarbonisation. In this sub-section, I draw from Marxian approaches to transitions that suggest the need to examine issues of class, scale, and power. A Marxian approach to transitions highlights the need to focus on what While, et al. (2004, p. 550) describe as "the neoliberal project of 'growth first'…" in urban governance and how that sets the conditions for the sort of accumulation required to decarbonise. My aim here is to emphasize that neoliberalization and capitalist restructuring in the context of Dublin's transition requires examining the structured *incoherence* of transitions in relation to the absence, incongruity, and limits of path creation. I argue that the sort of growth coalitions and accumulation strategies that drive the emerging geographies of the transition, the new socio-technical configurations, need to be examined in ways that emphasise their class politics. In short, the EV transition should be understood as a class project which produces a new geography of the city. A Marxian approach to transitions requires attending to the role of firms and individuals in creating new geographies and, in turn, how these new geographies will take shape in ways that reflect, interact with, and possibly adjust the uneven development of transitions as it relates to locality-specific alignments around the fixity-mobility contradiction.

Using a Marxian approach to understand urban transitions requires drilling down into the place at issue and analysing it with respect to the political and economic context, not least as it is characterised by capitalist accumulation. As Harvey (1993, p. 4) suggests regarding the concept of 'place,' "the first step down the road is to insist that place… is like space and time, a social construct. The only interesting question that can be asked is, by what social process(es) is place constructed?" For While et al (2004, pp. 555-566), at issue were social processes in Manchester and Leeds as they related to "the ability of local political and economic elites to manage, if not necessarily resolve, ecological demands emanating from within and outside the urban area." Sustainability conflicts are "rooted in *particular* geographies of valorization and devaluation in the contemporary city."

In Dublin, a crucial consideration is that efforts to decarbonize the city take shape without any significant structures of metropolitan governance. It is a city dominated by politics unfolding at the national and European scale, as well as by the various global production networks that cut into it. Analysing this situation, Moore-Cherry and Tomaney (2018, p. 365) advance the term "metrophobia" to refer to the governance structures of the Irish state. They note how "…a central state stranglehold over the Dublin metropolitan area is hampering the efficient governance and sustainable development of the city…" Furthermore, they argue that "these governance constraints at the sub-national level […] indicate a reluctance to engage with the metropolitan as a particular territorial scale in Ireland – and a profound fixity in the architecture of the state." Moore-Cherry and Tomaney argue that local instantiation of neoliberalism in Dublin emerged not so much out of any purposeful commitment to a market-oriented project but rather that "Dublin is 'more or less governed'… through formal and informal mechanisms, including clientelism and corruption, in uneasy relationship with institutions of government (p. 378)."

Several scholars have pointed to the role of successive waves of neoliberalization have played in shaping Irish politics and governance in recent years (see: Breathnach, 2014; 2010; Fox-Rogers & Murphy, 2015; Kitchin, et al., 2012). Fox-Rodgers and Murphy (2015, p. 46) demonstrate how the rolling back of the Irish state's planning regulations to ensure the provision of roads, green spaces and community facilities has resulted in "a failure… to effectively regulate, monitor and enforce how planning gains agreements are being implemented to ensure that the community facilities promised are ultimately secured." They argue that the weak bargaining power of Dublin municipalities limits their ability to steer private sector actors who are "in a commanding position based on the scale of resources they bring to the negotiating table." In contrast to the approaches engaging the multi-level perspective, Fox-Rodgers and Murphy point to the absence, incongruity, and limits to path creation in deepening neoliberal contexts. The inability of the public and private sector to steer or create pathways for the common good provides a basis for paying attention to the structured *incoherence* of transitions that emerge from failed or inadequate green growth coalitions and strategies.

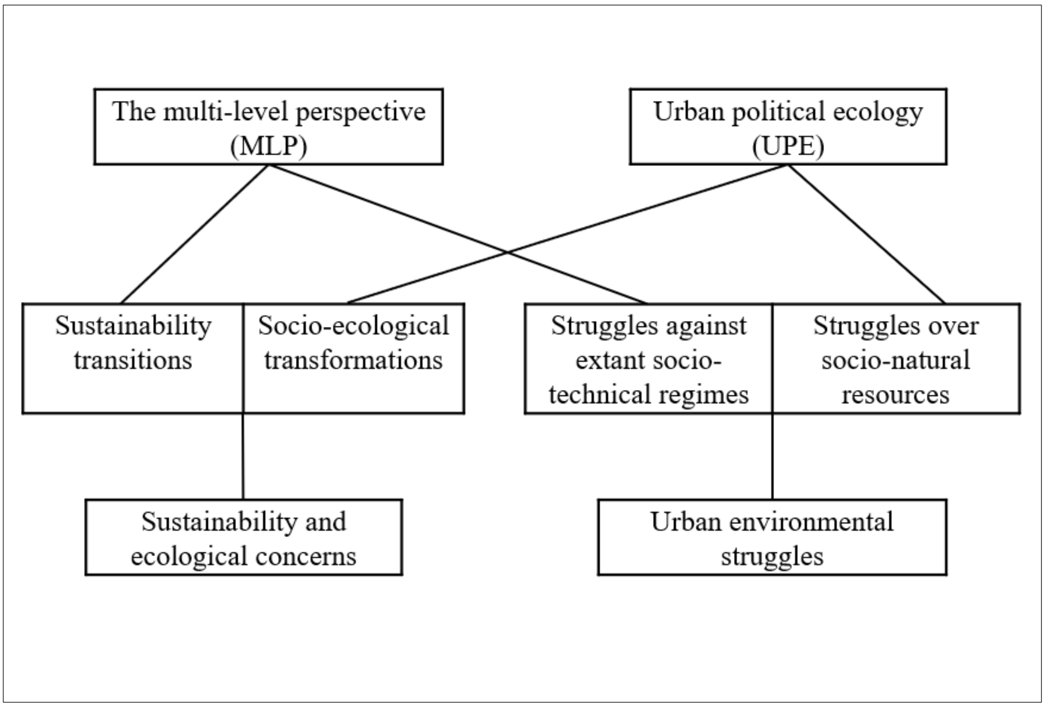
Against the backdrop of neoliberalism, therefore, the sort of growth coalitions and accumulation strategies that drive the emerging geographies of the transition need to be examined in ways that emphasize class politics. Of course, putting Dublin's transition into place demands, as Sheller (2018, p. 85) suggests, paying attention to how “class, race, gender, and ability might factor into such a transformation.” However, a Marxian approach implies that all such elements must be understood as shaped by the inconstant geographies produced by capital’s drive to accumulate. Class is a major factor in understanding who loses and who gains from investment decisions. Creating new configurations of resources to move the decarbonization project requires that resources are sunk into specific parts of the city or potentially withdrawn and redirected away from others. New forms of inequality emerge. A question for critical research on urban transitions is how unevenness is re-inscribed in the emerging geographies of the transition. A Marxian approach to CUTS requires an examination of the new geographies produced by eco-state restructuring; by new socio-technical realities taking shape; by the adoption or abandonment of new technologies; and by individuals and firms competing to produce specific decarbonization pathways.

2.4 Schematics of relations between frameworks

In Section 2.3, I brought the three fields of Critical Urban Transition Studies (CUTS) – the multi-level perspective (MLP), urban political ecology (UPE), and Marxian approaches to urban development – into conversation to discuss three conceptual moves that demonstrate the scope to conduct research using a CUTS framework. In this section, I highlight the manner in which the conceptual framework will be utilised in the remainder of the thesis. To do so, I present several schematics of relations between the three fields of CUTS and unpack how I will draw upon them within the findings of this dissertation. A point worth mentioning here is that throughout my analysis, I draw upon approaches that may not explicitly fall within the three fields identified. In fact, early iterations of my conceptual framework had centred approaches, such as path creation within the field of evolutionary economic geography, and mobility justice within the new mobilities paradigm. While these approaches are reflected within my overall analysis, I ultimately refined my framework around the MLP, UPE, and Marxian approaches to urban development because these approaches permitted me to investigate the emerging but chaotic relationship between technology, nature, and class within sustainability transitions. I finish this section by outlining an advanced conceptual schematic of my overarching CUTS framework, which brings into focus the overall connections between these approaches.

The first schematic I focus on concerns the connections between the multi-level perspective (MLP) and urban political ecology (UPE) (see Figure 2.3 below).

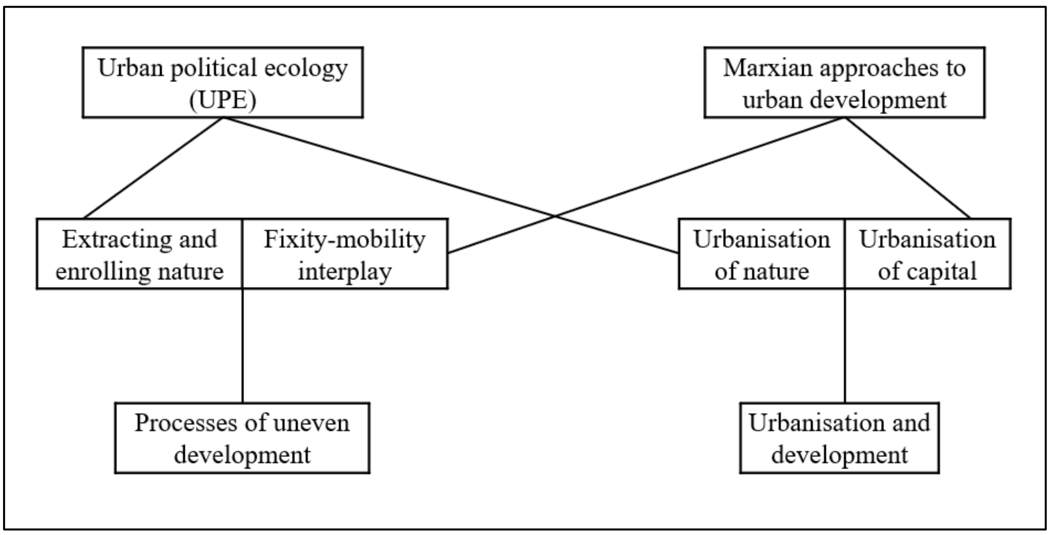
Figure 2.3 Schematic of connections between the MLP and UPE



Lawhon and Murphy (2011) have previously sought to introduce insights from political ecology to the MLP to highlight the human-environmental relations that underlie niche innovation. I build off these insights in two ways. First, I focus on how the niche action of sustainability transitions can set in train wider socio-ecological transformations within and beyond the city that can disturb and even undermine the so-called 'green' benefits of decarbonising technologies. Drawing upon the MLP and UPE, my aim is to extend the analysis of the decarbonizing city beyond carbon beyond with a view to unpack the less noticeable socio-natural flows that underlie the formation and expansion of nascent decarbonizing technologies, such as EVs. The decarbonising project will likely give rise to new harms, risks and vulnerabilities, the MLP and UPE can demonstrate the role niche innovation in addressing those concerns. Second, I demonstrate the ways in which the MLP's focus on power struggles between niche-innovation users and extant socio-technical regimes intimately relate to struggles over socio-natural resources within and beyond the city. Consider the ways in which decarbonising technology users contest the city with a view to creating 'new energy spaces' or 'premium ecological enclaves.' On the one hand, spaces such as EV charging stations have become key sites of urban environmental struggle against incumbent fossil regimes. On the other hand, this struggle develops with a view to secure ecological resources, for example, via grid reinforcement that redirects energy supply to EV charge points. My approach aims to understand the interplay between these two sets of struggles and how it the emergence of decarbonising technologies in cities. Overall, the connections between the MLP and UPE permit a type of analysis that can shine a light on the 'obscure' connections between the technological trajectory of Dublin's EV project and the ecologies underpinning it.

The second schematic I focus on relates to the connections between urban political ecology (UPE) and Marxian approaches to urban development (see Figure 2.4 below).

Figure 2.4 Schematic of connections between UPE and Marxian approaches to urban development

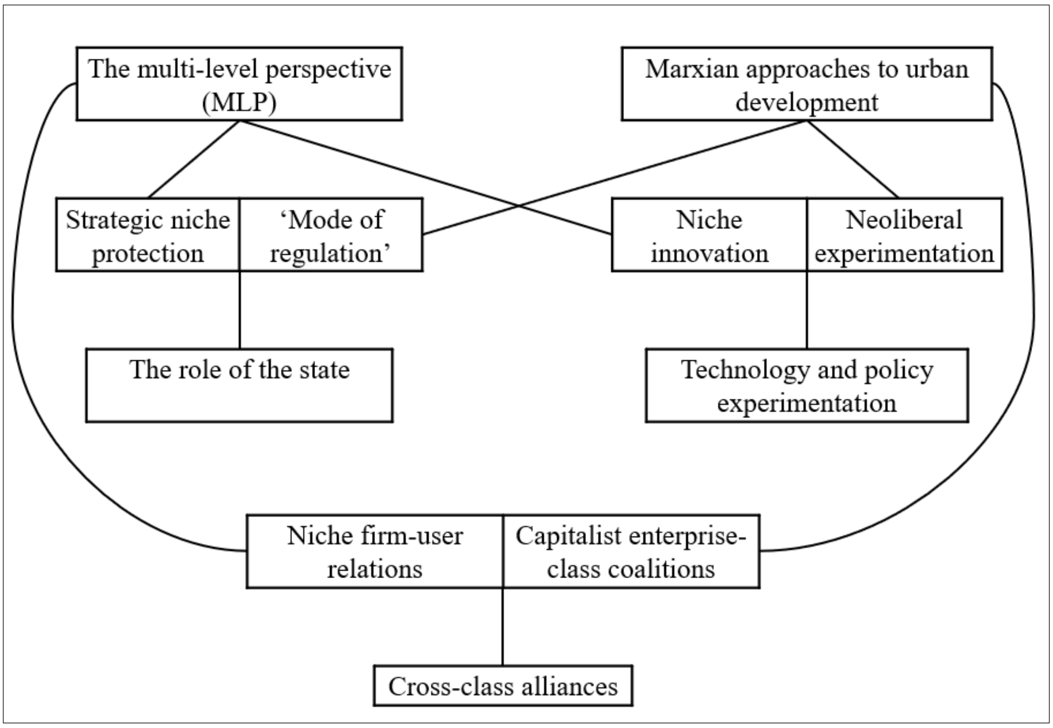


A crucial point here is that the relationship between UPE and Marxism are well established within critical scholarship on the city. As I have previously identified in Subsection 2.2.2, Marxist thought has been highly influential in shaping key concepts in UPE scholarship, such as 'urban metabolism' and 'the socio-ecological fix.' Yet, I argue the connection between UPE and Marxism are worth studying today, not as a predictable reflection of the past, but as a novel combination of longstanding forces that shape efforts to decarbonise the city. Considering these forces, I bring together UPE and Marxian approaches to urban development in two ways. First, I draw upon both fields to reflect and build upon the role of uneven development in decarbonising the city. The formation of new geographies aimed at decarbonizing transportation will reflect, interact with, and possibly adjust the uneven development of sustainability transitions. In the analytical chapters, I pay close attention to how the forces at work – the alliances, discourses, and interventions – create the locality specific conditions needed to decarbonise. In this regard, my analysis seeks to unveil the obscured aspects within the imaginaries advanced by various actors involved in the urban decarbonization process. While these imaginaries often highlight positive elements and transformative visions, I argue that they may inadvertently obscure or downplay more destructive elements inherent in the transition. This is crucial as these elements have the potential to reproduce the uneven development characteristic of global capitalism and, in turn, undermine the very process of decarbonization itself. By employing a critical lens that draws from both UPE and Marxian approaches, I aim to expose and scrutinize these hidden dimensions, shedding light on the complexities and contradictions within the pursuit of sustainable and low-carbon urban futures.

Second, I draw upon UPE and Marxian approaches to urban development to understand how the processes that aim to decarbonise the city, also seek to reproduce and draw upon the conditions for capitalist accumulation. Per Figure 2.4, this accumulation is intimately related to the production of the urban built environment via the urbanization of capital. Seen in this light, the creation of decarbonising infrastructures such as EV chargers can absorb surplus capital and create the conditions that enable automobile firms to expand their sales. At the same time, the decarbonising project and its associated regimes of accumulation commodify and transform nature in novel ways. This urbanization of nature can be seen in efforts to the expand industrial wind that supplies EV chargers with renewable but commercial energy that reduces pollution but commodifies transportation. My findings will unpack the locality-specific processes at work that connect the capitalist accumulation with the natural world in the formation of decarbonizing city.

The final schematic of relations I focus on relates to the connections between urban political ecology (UPE) and Marxian approaches to urban development (see Figure 2.5 below).

<ins>Figure 2.5 Schematic of connections between the MLP and Marxian approaches to urban development</ins>



Turning to the connections between the Multi-Level Perspective (MLP) and Marxian approaches within my CUTS framework, an initially apparent disparity between the MLP's roots in evolutionary economics and the revolutionary tendencies often associated with Marxian approaches may seem counterintuitive. However, this section aims to spotlight three vital connections between these seemingly divergent perspectives that I leverage in my analytical framework.

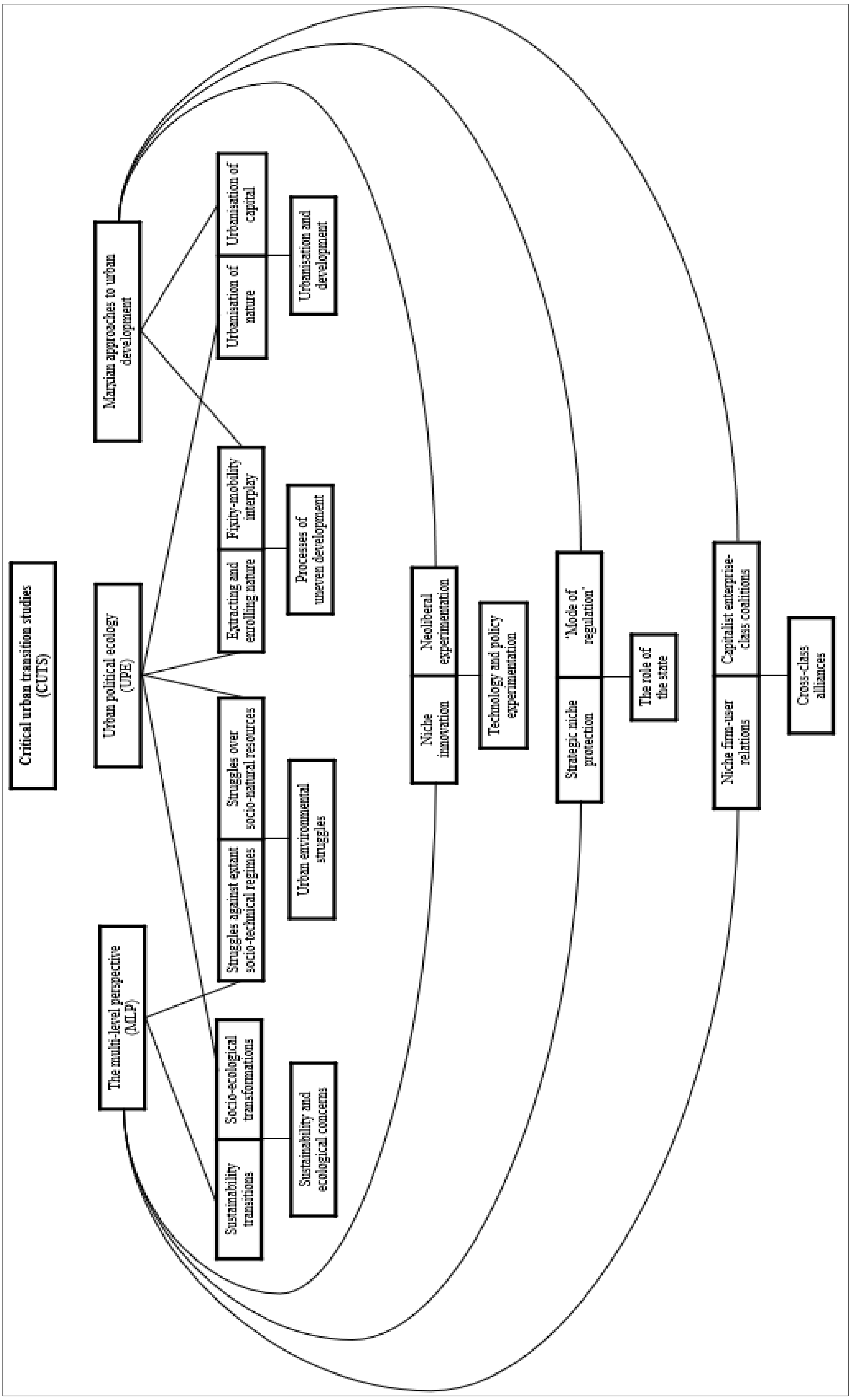
First, I build from connections between the MLP and Marxian approaches to urban development in my CUTS framework to conceptualise the role of the state in the creation and expansion of decarbonising technologies. Here, I delve into the intricate interplay between governmental agencies and the development of technologies aimed at reducing carbon emissions. By drawing on the MLP, which focuses on the state-led interventions, such as the policies and regulations, aimed at protecting and anchoring niche-innovations within existing socio-technical regimes, and Marxian approaches, which emphasize the role of the state in perpetuating capitalist systems, I seek to unravel how state intervention influences the trajectory of decarbonization. This connection enables a nuanced understanding of how governmental policies, incentives, and regulations shape the landscape of sustainable technology adoption and drive the transition toward low-carbon urban environments.

Second, I explore the inner connections between niche-innovation and neoliberal policy experimentation by bridging the MLP and Marxian approaches to urban development. This connection allows for a deeper examination of how niche innovations, often associated with experimental and transformative practices, interact with the broader neoliberal policy landscape. By explaining the dynamics between niche-innovation processes and neoliberal policy frameworks, the analytical framework aims to uncover the ways in which the distinct influences and interactions these realms have with each other. This exploration contributes to a comprehensive understanding of how neoliberal policies can either foster or hinder the development and mainstream adoption of sustainable technologies within the urban contexts.

Third, I bring together the MLP and Marxian approaches to urban development to examine firm-user relations in driving the sale and expansion of decarbonising technologies and infrastructure. By bringing together the MLP and Marxian approaches to urban development, I delve into the complex relationships between technology users and capital enterprises. This analysis goes beyond traditional perspectives on market dynamics to reveal novel types of coalitions emerging in the realm of sustainable technology adoption. It scrutinizes how the interests of technology users align with those of capital enterprises, forming alliances that influence the market dynamics for decarbonizing technologies. This connection sheds light on how collaborative relationships between seemingly disparate entities contribute to the proliferation of sustainable urban technologies.

Below, I outline an advanced conceptual schematic below of the overarching relations between each field of CUTS. Taken together, these connections can help to capture the dynamics interplay of technology, nature, and class in shaping low-carbon and sustainability transitions.

Figure 2.6 Advanced schematic of critical urban transition studies (CUTS)



2.5 Conclusion

Considering emerging debates around decarbonisation and environmental action, 'transition studies' has emerged as a broad set of approaches for examining large-scale shifts in the social-technical regimes underlying energy systems. In this chapter, I built on contributions to transition studies to identify three fields of critical work on urban transitions: scholarship engaging the multi-level perspective; work with a basis in political ecology; and Marxian approaches to urban transitions. Drawing from Harvey (2001, p. 9), I brought the three fields into conversation with one another to "rub different conceptual blocks together" and create space for "a new form of knowing" in what I argue geographers might refer to as 'critical urban transitions studies.' I then identified and discussed three ways to develop an understanding of CUTS.

First, CUTS might gain by paying direct attention to the role of socio-technical (mis)configuration in decarbonisation. A focus on configuration invites transition scholars to think about the ways cities are reworked not only through the plans, motives, and what Latour (2005, p. 12) describes as "wild innovations" of transitions; but also as part of "transitions failures" that provide useful counterfactual evidence against optimistic interpretations of transitions. Furthermore, a focus on failure can depart from more teleological understandings of transitions by conceptualising misconfiguration as recurring, generative and open.

Second, I have argued that CUTS need greater investigations on the ways nature is enrolled in transitions through the discourses and practices of actors when they push the decarbonisation agenda. Political ecology approaches to transitions point to the 'lively' role of nature in shaping social change. I have argued that the liveliness of configurations could be understood as a material-semiotic assemblage insofar as the emerging geographies of transitions create, and develop from, the social meanings of new energy spaces. Examining the enrolling of nature permits analysis of nature's complicated presence in transitions; configurations rely upon the exploitation and production of nature in complex ways.

Third, I have argued that not enough literature in CUTS studies examines the class dynamics of transitions. I view transitions as a class project in action. In contradistinction with the multi-level perspective, which suggests that path creation can and does drive transitions, a focus on the legacies of neoliberalism and capitalist restructuring suggests failure should be expected given the absence, incongruity, and limits of path creation. Structural *incoherence* is an inevitable characteristic of urban transitions in the contemporary context. At issue is the place-specific character of neoliberalism and capitalist development. Today's actions provide salient opportunities to examine how gains and losses are inscribed in the emerging geographies of the transition. In the next chapter, I build on my approach to CUTS by outlining the project's overarching research question, which I examine through three specific sub-questions. I then move on to introduce my investigative method in the context of Dublin, Ireland.

Chapter 3: Methodology

3.1 Introduction

In the previous chapter, I drew from scholarship on the multi-level perspective (MLP), urban political ecology (UPE), and Marxian approaches to urban development to advance my theoretical framework, which I refer to as critical urban transition studies (CUTS). The three areas are not an exhaustive list of critical fields that engage with transitions; rather, they mark valuable conceptual blocks that, when combined, can provide researchers with a useful scaffolding to critically examine urban transitions. This chapter outlines my investigative method. Like many doctoral students, the Covid-19 pandemic prompted me to shift my research activities online, where I completed the entire course of fieldwork remotely using a laptop and numerous software platforms and services. My aim, then, is to reflect on what I describe as my 'digitally immersed research methodology' and consider its implications for the wider outcomes of my overall research.

I organise this chapter as follows. In Section 3.2, I outline my overarching research question, which I examine through three specific sub-questions. In Section 3.3, I review my qualitative approach to researching decarbonisation. I engaged three respondent groups: (1) Drivers using battery electric vehicles (hereafter, EV users) in the Greater Dublin Area (GDA); (2) Respondents in the private sector with expertise in decarbonising processes, e.g., companies rolling out infrastructure for electric vehicles; (3) Respondents in national and local government as well as public agencies with expertise in decarbonising processes, e.g., SEAI, Dublin City Council. In Section 3.4, I explain my primary and secondary methods, including my data collection activities, online qualitative interviews, and analysis. In Section 3.5, I reflect on my use of my digitally immersed research methodology through three instances in which the digital nature of my fieldwork shaped my research practices and outcomes. In Section 3.6, I discuss the limitations of my methodology. Finally, in Section 3.7, I bring the chapter to a close.

3.2 Research Design

I conducted research with the following questions in mind. My central research question asks: *How do alliances of public-private actors and EV users assemble, mobilise, and drive efforts to decarbonise Dublin's transportation sector?* More specifically, I ask: (1) What are the types of relationships emerging between the actors driving to decarbonise Dublin's transportation sector? (2) How do actors driving the decarbonisation process encounter and overcome obstacles in their path? (3) What are the experiences of using, promoting, or governing decarbonising technologies like?

I posed three open-ended sub-questions that specify the core question into some areas of inquiry, keeping them open-ended to reflect the explorative nature of the study. As the research progressed, I reshaped and refined the questions in line with the development of my methods, material, and analysis. In the context of the Covid-19 pandemic, the public health situation placed barriers on my research design by limiting my ability to physically interact with respondents via face-to-face interviews or ethnographic methods that require physical co-presence. Given the wider public health advice, I designed my research to be digitally immersive. I discuss the limitations of my design and activities in Section 3.6.

3.3 Methodological strategy

I shaped my research methodology to explain the structures, agency, relationality, and discourses of the three respondent groups highlighted in Section 3.1 above. My initial reaction was to place the respondents within a range of categories, such as – early adopters (Kuby, 2019), path advocates (Harris, 2020), innovators (Simmie, 2020), or leaders, laggards or inhibitors (Andresena & Agrawalab, 2002). However, upon my engagement with the field, I discovered that these categories were relatively fluid insofar as the actors driving the transition adapt, perform strategic actions, and express situated agencies that move across a variety of criteria. As Becker, et al. (2016, p. 32) suggest, "the ability of actors to reshape existing structures is derived from the relation of situated agency and selective structure over time." I adopted a qualitative approach because it generates knowledge that may help explain the heterogeneity and flux of actors involved in the decarbonising process (see: Maxwell, 2009). In addition, a qualitative methodology can apprehend respondents' viewpoints and social worlds to interpret phenomena in terms of the meanings people bring to them (Denzin & Lincoln, 2011, p. 2). Moreover, a qualitative approach allowed me to, what Latour (2005, p. 12) might describe as "follow the actors themselves", to interrogate first-hand the underlying actions, motivations, and logics behind the social processes they enact and encounter. In this regard, my research focal points permit me to trace the public and private entanglements and interventions that shape decarbonisation on the ground.

Efforts to conceptualise the interplay between structure and agency have been features of transition research in the past (Becker, et al., 2016). I identify 'agents of change' under the three respondent groups. There are, however, nuances worth mentioning. I focus on five. First, EV users are a heterogeneous group that includes different demographics, technological capacities, roles in innovation diffusion, and perspectives. The politics of EV adoption groups are messy, contested, and diverse but intimately relate to the broader structures of the transition. The EV owners' groups and associations I encountered were made up of members who approve of a variety of vehicle and infrastructure models, policies, subventions, and environmental perspectives. Yet, there were overarching wants, needs, and desires that connected these groups.

Second, and similar to my point on EV users, the objectives of the public and private sector actors were often heterogeneous. Consider that society has never had a 'system' of automobility (see: Urry, 2004) outside of internal combustion engines (ICEs), and although EVs are central to the EU's climate action efforts (see: EEA, 2021), the innovations underlying them are constitutive of a nascent technological regime that is marked by variation – different EV models rely on various forms and degrees of battery chemistry, automation, charge point specifications, and renewable energy technologies (For an overview of EV technologies and components, see: Un-Noor, et al., 2017). Furthermore, the sectors driving the turn to EVs, in many cases, are collaborating across new terrain with a view to producing a level of coherence around the EV project. As a result, the pathways forward can be chaotic and complex, which is a theme that echoes through the analytical chapters.

Third, my methodology reflects the social scientific tradition of 'studying up' (see: Nader, 1972) insofar as I aim to investigate the cultures of hegemony, power and affluence that shape economic and environmental transitions. I argue that respondents driving sustainability transitions must be understood in the context of the messy and uneven geographies in which they operate. Consider the role of EVs in driving extractivism via the formation of sacrifice zones in the global south (Arboleda, 2020). The actions of EV users and public and private sector actors intimately relate to these contexts. At the same time, my methodology *also* aims to 'study through' (see: Allen, 2016; McCann & Ward, 2012), that is, to trace the ways in which power can quietly modulate and entangle actors across time and space to alter the dynamics of the transition.

Fourth, my methodological strategy aims to bring to the surface the specific dynamics of decarbonising *cities*. Not enough attention has been to role of cities in the production of new 'low carbon' geographies. By drawing upon an urban geography lens (e.g., the 'urban' in CUTS), I shaped my methodology to capture the inter- and intra-urban dynamics of Dublin's turn to EVs. A crucial point here relates to the role of urban governance in shaping new inter-urban dynamics, called forth by actors in Dublin as they look to draw from so-called pioneer cities such as Oslo to form ideas of 'best practice' or as they seek to transpose EU policy to create more 'eco' or 'environmentally friendly' policies. Cities are becoming key sites for promoting the virtues of decarbonising; the 'urban' is a vital boundary for administrating low-carbon transition that demands attention.

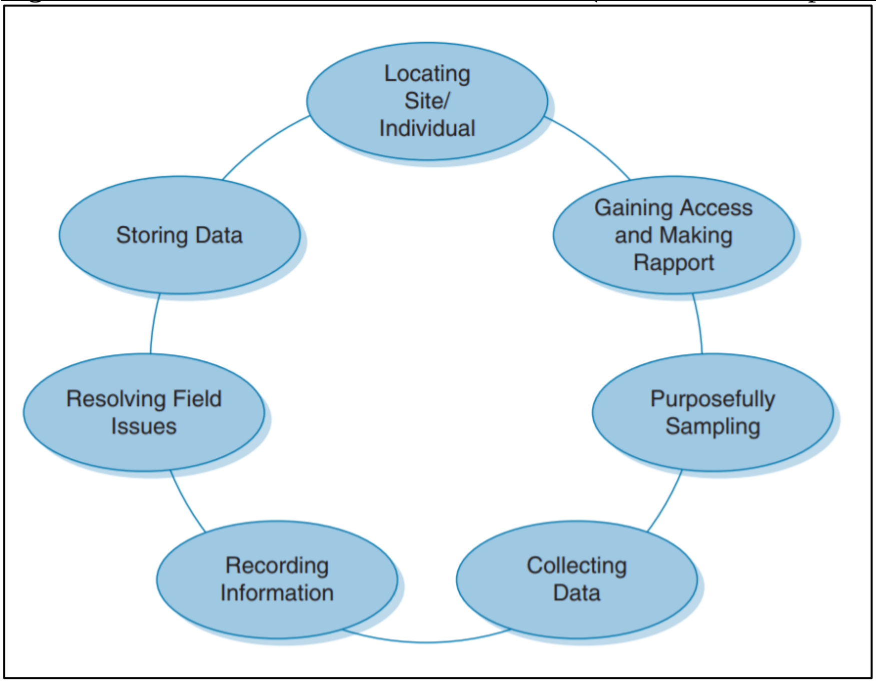
At the same time, there are new intra-urban dynamics that are also at issue here: urban imaginaries, instabilities, and rhythms. Public EV charging infrastructure hosts an entirely different temporality to the petrol pump, furthermore, novel spaces of consumption and practice are appearing around EV charging infrastructure. My methodological strategy, therefore, has sought to understand the city as ‘a space of practice’ in which actors driving the turn to EVs learn and develop new urban modes of living around new decarbonising infrastructures and configurations. However, these modes of living should not be viewed in isolation; rather, they are connected to wider processes of urbanization, such as road building and urban sprawl. Questions remain to be answered about the specifically urban dynamics at work in the making of these configurations and processes, my methodological strategy has sought bring to the surface exactly how public and private actors engage the urban scene to drive the decarbonising city.

Finally, there are further nuances between what might be understood as experts/elites in the context of the public and private sector respondents and early adopters/early majority users in the context of EV users. My point here is that actors express different expertise, experience, and power dynamics. However, while it is important to recognise respondents’ experiences as distinct, they are also relationally interwoven within the regimes of accumulation, modes of regulation, and subjectivities that underlie shifts in capitalist development (see: Jessop, 2002; Boyer, 2018). Sustainability transitions produce and draw upon novel social relations in which the roles, practices, and knowledge of individuals are always differential, but their relationality links up these elements into totalities. Therefore, their experiences can be separated analytically but not as a lived experience. I now zoom in on the application of my methods with a view to explaining the ways in which my fieldwork helped to shed light on the agency, relationality and discourses of EV users and private and public actors.

3.4 Methods in practice

In this section, I outline the application of my methods. I draw from Cresswell’s ‘data collection circle’ (2013, p. 146: see Figure 3.1 below) to develop my broad research activities. I categorise my activities into four sections.

Figure 3.1 The data collection circle. Source: (Creswell, 2013, p. 146)



First, I discuss my efforts to locate respondents by outlining my recruitment and sampling strategies. I highlight the ways in which I coded my interviews to support the sampling process. Second, I discuss my use of qualitative interviews and reflect on the advantages and routine practicalities of this method. Third, I briefly outline my secondary method, which involved creating what I refer to as 'actor-organisation profiles'. These profiles consisted of records, such as newspaper articles and press releases, that provided relevant information on each public and private sector respondent in addition to key individuals and groups operating in Dublin's EV sector. Fourth, I discuss the ways in which my methodology helped to create a reflexive and iterative mode of analysis.

3.4.1 Finding respondents

Doctoral research like mine hinges on finding respondents. In the first instance, my strategy for locating EV users revolved around purposive and snowball sampling via social media platforms and online chat forums. Drawing from Lynch and Mah (2018, p. 742), my approach was to gain familiarity with Dublin's EV users by investigating their social media "… structure, history, content, and administration." When I identified relevant groups, I contacted their administrators and highlighted my research's purpose and parameters, and the administrator would then facilitate me by permitting me access to contact the members of their group or by contacting potential respondents on my behalf. In addition to these activities, I attended virtual events via platforms such as Zoom with a view to identifying potential respondents. These events included Ireland's annual Electric Vehicle Summit and the Irish Electric Vehicle Owners' Association's (IEVOA, hereafter) Used Car Seminar. These events helped me understand the ways in which EV users in Dublin understand and interact with the public and private sector actors driving the transition.

Once I had identified potential respondents, my approach was to use a combination of purposive and snowball sampling from three key groups/sites: First, I targeted place-specific owner associations, such as IEVOA or Dublin EV Owners Club; second, I approached technology-based owner associations, such as Tesla Owners Ireland and Nissan LEAF Owners Ireland; third, I used internet and social media forums, such as the Irish EV Owners on Facebook. Innovation research demonstrates that early adopters are key to innovation diffusion (Hölsgens, 2021). I considered developing my sampling strategy to categorise EV users in terms of their relative experience as highlighted in 'innovation diffusion models' (see: Rogers, 2003)[1] or in terms of their driving practices and charging practices. However, I ultimately shaped the parameters around motorists using EVs in the Greater Dublin Area (GDA). Figures 3.2 and Figure 3.3 highlight a map of charging stations within Dublin City and Dublin County.

[1] For example, Rogers (2003) identifies adopters within stages of innovation diffusion: the innovator, early-adopter, early-majority, late majority, and laggard phases. The respondents identified the third phase 'the early-minority phase' as the likely category during which my fieldwork took place.

Figure 3.2 Map of charging stations in the Dublin City area.

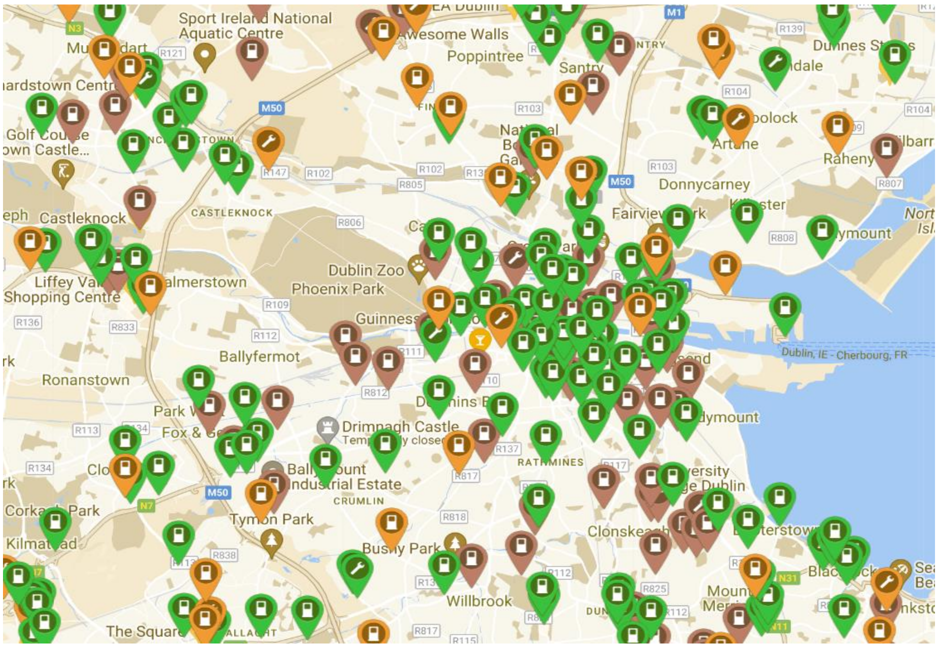
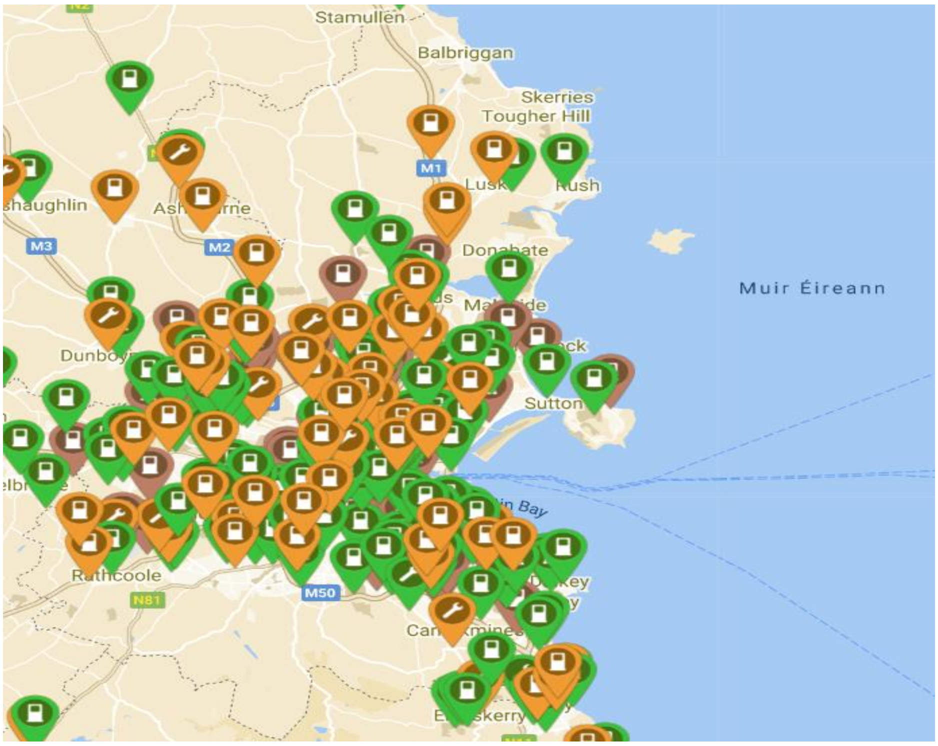


Figure 3.3 Map of charging stations in the Dublin County area.



In addition to these parameters, I devised my recruitment strategy around different types of spatial and commuting criteria. For example, I outlined to prospective respondents that I was interested in the wide variety of commuting and charging patterns that EV users had, and in spatial issues such as whether EV users could charge at home, lived close to chargers, or charged when commuting or during downtime. I also altered my recruitment strategies to promote a gender balance and to engage with a diverse set of EV model types when necessary. Table 3.1 outlines the response rate and relevant biographical information of EV users. Figure 3.4 highlights the different EV models driven by respondents. I provide precise biographical information on each specific users in Appendix E of this dissertation. I do not outline any unique identifiers or personal information to ensure confidentiality and anonymity.

Table 3.1 Response rate and biographical information of EV users

i. Response rate

Responses	Total
No. of EV users directly contacted	59
No. of EV users interviewed	39
No. of unmet respondents	20
Response rate	66.1 per cent

ii. Gender profile of EV users

Women	Men
2	18

iii. Age profiles of EV users

Age	22-31	32-41	42-51	52-61	62-71
No. of respondents	1	12	8	8	10

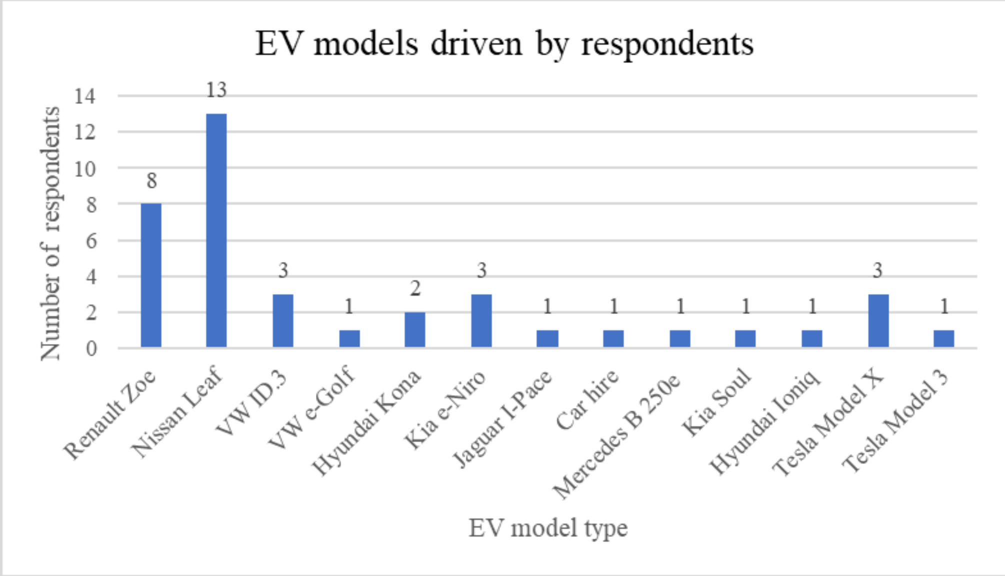
iv. Gender profile of EV users

Women	Men
2	18

v. Respondents' years of experience driving an EV

No. of years	>1	1-2	2-3	4-5	5-6	6-7	7<
No. of respondents	10	5	4	1	9	2	8

Figure 3.4 EV models driven by respondents



I devised my strategy for locating private and public sector respondents by drawing from interview data with EV users. I began by thematically analysing EV users' transcripts to draw upon who they identified as key public and private sector actor organisations. I then created a scoring matrix to calculate the number of times EV users mentioned relevant actor-organisation and to assess the importance they attributed to each actor-organisations. I pay closer attention to these analytical points in Section 3.4.4. Next, I used keyword searches of industry press releases and newspapers to identify key actor-organisations, and where possible, I used personal contacts to identify appropriate individuals. Finally, I snowballed from individual respondents to identify relevant individuals in their social networks. A crucial point here is that a challenge for expert or elite interviews is "getting in the door" (Goldstein, 2002, p. 669) or, in other words, gaining access to respondents (see also: Delaney, 2007; Mikecz, 2012; Robinson, 2021). In many cases, I contacted firms directly with a view to gaining access to public and private sector respondents. My strategy often entailed cold calling or emailing firms in an attempt to gain access through 'chains of commands', particularly in the more vertical organisation. This strategy was mostly unsuccessful. However, where I did find success was via social media platforms such as LinkedIn, Facebook, and Twitter, which facilitated personal access to public and private sector respondents.

Table 3.2 outlines the response rate and relevant biographical information of public and private respondents. I provide precise biographical information on each specific respondent in Appendix F and Appendix G of this dissertation. I do not outline any unique identifiers or personal information to ensure confidentiality and anonymity.

Table 3.2 Response rate and biographical information of private and public respondents

i. Response rate					
Responses			Total		
No. of private and public sector respondents contacted			59 (39 private/ 20 public)		
No. of private and public respondents interviewed			33 (23 private /10 public)		
No. of unmet respondents			26		
Response rate			55.9 per cent		
ii. Gender profile of private and public respondents					
Women			Men		
4 (3 private/ 1 public)			39 (20 private/ 9 public)		
iii. Private respondents by sector					
Private					
Automotive	Energy	CPO	Finance	Logistics	Media
10	6	4	1	1	1
iv. Public sector respondents by sector					
Energy	Transport	Politics			
6	3	1			

3.4.2 Interviews

I conducted online semi-structured interviews based on the position that actors' knowledge, views, and experiences are meaningful properties of the social realities behind the decarbonising process. I standardised my interview guide depending on the respondent group, but I included space for context-specific questions depending on the role of the interviewees. As Mason (2002, p. 64) suggests, "if your view is that knowledge and evidence are contextual, situational, and interactional, then you will wish to ensure that the interview itself is as contextual as possible in the sense that it draws upon or 'conjures up', as fully as possible, the social experiences or processes which you are interested in exploring." I constructed my interview to conjure up the unique positions of individual respondents to understand how their experiences collectively hung together to shape the dynamics of Dublin's EV transition. I attached three interview guide examples (an interview guide for EV users, private sector actors and public sector actors) in Appendix B, C and D of this dissertation.

According to Hitchings & Latham (2019), interviews are the most widely used method in human geography, however, very little procedural detail or what they refer to as "nitty gritty" (p. 392) appears in publications. The result is a significant methodological gap in the discipline with regard to the ways in which the interview process shapes research outcomes, positionality, and experience (Hitchings & Latham, 2019, p. 392). Therefore, I discuss some of the finer procedural details of interviews with each respondent group that shaped my experience. In total, I conducted 72 interviews with respondents, which included 39 EV users, 23 private sector respondents, and ten public sector respondents. My interviews with EV users took place over six months between December 2020 and May 2021; 18 of the EV users were women and 21 were men; and the average number of years EV users drove an EV was 4.5 years. The interviews with EV users lasted around 61 minutes. Seven took place over the telephone and 31 on teleconferencing software. I used telephone interviews when respondents were not comfortable with teleconferencing software. I received informed consent verbally at the beginning of each discussion and by way of an information sheet and signed consent form.

I designed the initial questions with EV users to be situational. I attempted to tease out the challenges and relationships EV users confronted in different settings of their adoption and use, from purchasing cars, installing chargers, and using public charge points, to the driving experience. Questions include: ‘What were the main obstacles in acquiring your EV?’; ‘What is the experience of using a public charge point like?’ I emphasised to respondents the need to highlight the relationships and practices that helped or hindered their experience. The initial stages of the interviews shined a light on the agential aspects of the EV users’ experience in terms of the everyday practices they partake in and how these practices connect with the wider EV sector. The latter stages of the interviews sought to highlight the connections between EV users and the political-economic landscape underpinning the transition. In this regard, I aimed to understand how EV users seek to shape the policymaking or planning process. Questions include: ‘Do you try and shape policy and how?’; What role do owners' associations play in the planning process?’

The interview process foregrounds what Hitchings and Latham (2019, p. 393) consider big ‘P’ positionality issues – the way personal characteristics and relative power dynamics shape research – and small ‘p’ positionality – in practical terms, how we go about presenting ourselves to, and engaging with respondents, and what that means for how they speak with us. It is not uncommon for EV users to have in-depth knowledge of the technology. Early adopters of decarbonizing technologies tend to have a higher level of expertise than later adopters, perhaps due to environmental concerns or enthusiasm for the technology (see: Palm, 2020). Line, et al. (2011) suggest early adopters of this sort are ‘informal experts’ insofar as users exhibit expertise, but their knowledge is formed through personal interest rather than through a professional role. This dynamic disturbs the notion of what might be considered a non-expert interview into something of a grey area. Moreover, these dynamics can create challenges in terms of how EV users engage with the research.

As part of my interviews, I tried to prompt EV users to reflect on some controversies surrounding EV transitions. For example, I probed interviewees to consider their EV adoption in relation to wider power structures in the context of gender and class relations, or I explored how EV users negotiate the environmental politics of EVs in the context of the extractivism that underpins EV technologies (e.g., for discussion on lithium conflicts see: Riofrancos, 2019). Eliciting the 'informal expert' accounts of EV users was valuable, but my lines of inquiry occasionally provoked an argumentative response. While these responses provided useful accounts of discourses and practice underlying the transition, for pragmatic reasons, I tended to shape my line of question in a tentative way to avoid appearing antagonistic towards EV adoption. In other words, I made strategic decisions to address, per Hitchings and Latham, my small 'p' positionality. This approach encouraged the recruitment process, for example, EV users were more likely to encourage others to participate in the study.

As part of my interviews with the private sector actors, I interviewed 20 men and three women. Among the private sector respondents, one worked in the financial sector; one worked in the media; one worked in transport and logistics; four worked in the charge point sector; six worked in the energy sector; and nine worked in the automobile sector. On average, the interviews lasted 77 minutes and each interview took place via teleconferencing software. For public sector actors, I interviewed nine men and one woman. Among the public sector respondents, one was an elected official; three worked in the transport sector; and six worked in the energy sector. On average, the interviews lasted 69 minutes and each interview took place over teleconferencing software. I received informed consent from both groups in a manner consistent with EV users. I structured my interviews around four broad themes. First, I sought to contextualise the role of the respondent. Second, I engaged with the collaborations, challenges, and obstacles respondents encountered in their work. Third, I probed some specific dynamics of their work, including financing and costs of their activities. Finally, I gauged their perspectives on the leaders, laggards, and inhibitors of the EV transition in Dublin. My overall goal was to shed light on the emergent coalitions taking shape between public and private actors, the key interventions that these actors make, and how they prompt, push, and pull one another with a view to steering the turn towards EVs.

In a similar vein to my engagement with EV users, my interviews with the public and private sector involved navigating some sensitivities. My academic training so far has developed around critical urban geography, which tends to be associated with what Peck, et al. (2013, p. 1097) describe as a "restlessly antagonistic stance towards orthodox urban formations and their dominant ideologies, institutional arrangements, practices and societal effects." My interviews with the public and private sector respondents frequently involved discussions on topics that I disagreed with politically. Although the interviews were non-sensitive, where disagreements cropped up, I was courteous and polite and practised what might be understood as 'strategic silences' at points when conflicts of opinion emerged. Qualitative interviewing permitted me to negotiate sensitivities in real time, placing more agency in my hands to shape the discussion.

3.4.3 Secondary Methods

My secondary methods exposed more of the inner workings of actors and organisations. The secondary data was produced through my use of digital repositories, such as LexisNexis, to identify relevant newspaper articles and press releases. I drew from these sources to deepen my archives on particular subject matters, identify potential respondents, and triangulate the interview data. A crucial part of this process related to the construction of what I refer to as 'actor-organisation profiles' on relevant individuals and groups. These profiles consisted of three layers of information on specific actor-organisations: first, their extra-local activities; second, their local activities; and third, actor-specific information (e.g., interviews with CEOs). I also used repositories available on social media platforms, such as Facebook, Twitter, and LinkedIn, that allowed me to store and assess content and information relating to Dublin's EV transition. I have attached an image of these repositories in the Appendix H of this dissertation.

These digital tools shined a light on the roles and experiences of respondents in the public and private sectors and supported online interviewing in practical ways. For example, I reshaped my interview guide, search criteria, and sectoral knowledge by considering the information gathered via these secondary methods.

In addition to these methods, I have received other useful secondary data through my discussion with respondents. For example, I received ESB's AC and DC charging surveys completed by 490 members of IEVOA. I also have received figures on the annual breakdown of vehicle type, fuel type, and fuel expenditure by division in all four of Dublin's local authorities. I have also useful secondary data via information request under the re-use of Public Sector Information (PSI) regulations, such as the annual breakdown of vehicle type, fuel type, and fuel expenditure by division in all four of Dublin's local authorities. In addition, I have data on the number and costs of the EV grants supplied by the Sustainable Energy Authority of Ireland (SEAI). These data are not publicly accessible but are available for re-use. One final point on my secondary methods relates to the various industry and community events I attended, including Ireland's Electric Vehicle Summit, which highlighted the ways in which the pandemic had impacted Ireland's EV auto industry from the perspectives of key figures in firms such as Nissan, Honda, and Renault.

3.4.4 Analysis

I structured my analysis around reflexive and iterative processes. As Srivastava and Hopwood (2009, p. 76) suggest, "the role of iteration in qualitative data analysis, not as a repetitive mechanical task but as a reflexive process, is key to sparking insight and developing meaning." I built reflexive and iterative processes in five ways. First, during the transcription process, I coded appropriate aspects of the interview to inform my sampling and interview guide. In this respect, the processes of coding and analysis shot through my entire methods as well as the subsequent analysis. Second, as outlined in Section 3.4.1, I created a scoring matrix to identify relevant organisations. I have attached the scoring matrix for the following sectors to the appendices of this dissertation: Appendix I – Automotive Sector, Appendix J – Owners' Group, Appendix K – Charge Point Operators (CPOs), Appendix L – State Authorities. These are not an exhaustive list of sectors driving the turn to EVs but demonstrate the ways in which I operationalized the scoring matrix. Moreover, the scoring matrix also provided a useful conceptual map of the relevant actors operating in Dublin's EV space, which I used to find angles for secondary data analysis. Third, I kept a digital journal throughout my fieldwork by using the digital platform 'Google Keep', in which I wrote post- and pre-fieldwork notes. These notes allowed me to draw connections between my thoughts on the interviews over the course of the research. Fourth, I used a suite of digital software and devices to code and transcribe the data. These programs included software, such as Otter.ai, which allowed me to make brief notes during the transcription process that later informed the coding and analysis. Finally, I used MAXQDA to thematically code the research, which permitted me to create multiple codebooks and compare my results.

3.5 Digitally immersed research

Irish society's reaction to Covid-19 accelerated the digitalisation of key sectors in society, in which fundamental aspects of doctoral research – teaching, working, and socializing – shifted to remote working platforms, such as Microsoft Teams and Zoom. I argue that the role of digital technologies in shaping remote research activities during the Covid-19 pandemic is worth reflecting on. Indeed, digital technologies have underpinned social science fieldwork for decades. Digital objects such as laptops, smartphones, and digital recorders shape the routine practicalities of contemporary research activities insofar as the day-to-day field tasks such as scheduling, writing, recording, and communicating are, in many cases, born-digital (Dobson, 2001). Geographic methods such as telephone interviews (see: Cook, 2009), content analysis (see: Meek, 2012); online interviews (see: Longhurst, 2020); and digital cartographic methods (see: Poorthuis et al., 2020) have all drawn upon digital technologies for some time now and allow researchers to connect with individuals, objects, and sites across a range of times and spaces.

Yet, as I now demonstrate, the digitally immersed field that I engaged in during the Covid-19 pandemic produced a range of novelties that shaped the outcome of the research. A crucial point here relates to the role of mediation insofar as all my interactions, which took place during my fieldwork, were through screens. My fieldwork was a coming together of, as Leszczynski (2018, p. 19) might describe it, “content, technology, space, and the social.” I argue that digitally immersed research of this nature alters the relationship between researchers and respondents in ways that can transform the knowledge produced in the field. Novel intensities and hazards relating to remote interviewing can alter the dynamics of the field. Any breakdown or glitch during the interview process can disrupt or even destroy essential data. However, digital affordances, I argue, also create new windows of opportunity for researchers. For example, via screen-sharing or chat functions that enable participants to share images, audio, and texts instantaneously. In light of these novelties, this section reflects on the dynamics of doing digitally immersed research in a pandemic by paying particular attention to three digitally driven issues that shaped my research practices and outcomes.

3.5.1 Technical stability

The first issue relates to the overall technical stabilities of digitally immersed research. As I have previously noted, my research hinged on an assemblage of digital research devices, practices, and content. I had a suite of digital recorders, laptops, transcription kits, Wi-Fi, and smartphones. I required each object to be connected with one another to produce, assemble, record, and assess the research. There were pressures, tempos and choreographies that shaped my work. A key point here is that opportunities to interview potential candidates frequently arose quite suddenly. At the time, many of the professional classes were working from home, and respondents tended to slot me into their schedules readily. I needed my devices at hand, fully functional and fully charged, in the event that an opportunity to interview a respondent arose. I have attached a table of my personal suite of devices and software to Appendix M of this dissertation. Furthermore, I developed several practices to support my fieldwork activities. For example, I needed to familiarise myself with a repertoire of applications, such as Google Meet, MS Teams, and Zoom, to manage the interview process. I constructed contingency plans in the case of technology failure that I outlined to respondents (e.g., switching devices or from online to telephone). However, even with preparation, breakdowns in the interview process frequently occurred. On five occasions, I was forced to switch platforms, and on one occasion, I switched from a teleconference to a telephone interview. On other occasions, I had to cut interviews short due to connection issues.

These instances seem mundane but are a routine and crucial part of conducting digitally immersed research, in which the field is a wide-open but turbulent, and at times unmanageable, terrain. In other words, digitally immersed research develops in what Townsend (2013) might describe as a 'buggy and brittle' field. Socio-spatial inequalities and digital divides characterise digitally immersed research insofar as researchers need forms of digital literacy that are unevenly obtained and access to (functioning) Wi-Fi networks and devices (see: Reuschke & Felstead, 2020). Moreover, researchers need respondents who have a similar level of access and skills. I was privileged enough to be able to pursue my research remotely and develop a digital approach, although not without its own set of instabilities and anxieties. I argue that these insecurities developed in a context where failure is something of a taboo in human geographic fieldwork. As Harrowell et al. (2018. p. 230) argue, "… geographers have widely accepted the notion that qualitative research […] is an inherently "messy" process […] Yet this embracing of messiness has not been accompanied by a widespread acceptance that failure is an integral part of what we do."

3.5.2 Control over the sampling strategy

The second issue relates to the control researchers have over the sampling process. In the context of purposive sampling, I identified respondents using social media platforms. Social media analysis features in geographic research aimed at mapping and mining content (see: Shelton, 2017; McKitrick, et.al., 2022; Poorthuis, et.al., 2020) and scholarship seeking to examine the identities, politics, and social group dynamics in online environments (see: Gossling & Stavrinidi, 2016; Arora, 2015; Meek, 2012). However, the ways in which researchers navigate the peculiarities of social media platforms have gained less attention in geographic scholarship. I argue it worth reflecting on my use of social media platforms to sample, while considering how it created novel stresses around efforts to 'stage' myself as a researcher online.

The work of Robinson (2021) is instructive here, in which he reflects on the benefits of LinkedIn's functionalities in accessing hard-to-pin-down respondents. He sheds light on the advantages of using the granular search functions of LinkedIn to identify and access hard-to-pin-down expert or elite respondents. LinkedIn, like other social media websites, provides a search function that allows researchers to refine their searches to assess information, such as the employment history, biography, interests, and association organisations of potential research participants. I drew from Robinson's approach and extended it across a wide set of social media platforms (e.g., Twitter, Facebook). These platforms, moreover, provide repository functions, which can be used to save key news items, content, and posts, which can be drawn on for secondary data purposes. Furthermore, these platforms advertise and occasionally host relevant events that were central to my sampling strategy. For example, in a post relating to Ireland's Electric Vehicle Summit, a debate took place in which EV users criticised the condition of Ireland's high-speed EV charging network.

The instances highlighted above not only left an impression on my overall analysis but allowed me to identify relevant voices within the so-called 'EV community' in Dublin and contact potential research participants. As a result, I could paint a wider picture of the respondents I interviewed outside of the otherwise ephemeral interactions associated with interviewing. I argue that this practice is akin to what Kitchin and Fraser (2020, p. 86) refer to as 'data dancing' in the field insofar as I developed digital choreographies to access and conceptual map out the wide terrain of actors shaping the transition. Geographers have identified ethical issues relating to social media analysis in the past, such as struggles over privacy (see: Elwood & Leszczynski, 2011) and challenges in ensuring informed consent (see: Flick, 2016). During my sampling and analysis, I took additional measures to ensure the ethical standards of my approach, such as contacting administrators before engaging with groups (as outlined in Subsection 3.4.1). However, despite the outlined benefits of sampling via social media, there are disadvantages that I argue are worth noting, specifically in relation to 'staging' the research online. My sampling strategy hinged on social media but, in turn, required me to engage in practices which consumed a lot of my time, blurred the lines between my work and social life, and required me to boost my research project in ways, which I argue, reflect how the academy pressures researchers to become a more “desirable, educated and flexible labour commodities” (Jones, 2019, p. 291).

3.5.3 Dealing with unexpected affordances

The third issue I discuss relates to how I dealt with the unexpected affordances of online interviewing. Hanna (2012) highlights the ideological, methodological, and practical benefits of using online interviewing as an alternative to in-person interviews. For example, there are benefits with regard to scheduling and degrees of freedom to shift times. Moreover, the method also allows researchers to “stay at the level of the text” (Hanna, 2012, citing: Holt 2010, p. 115) by avoiding the subtleties associated with physical interaction, which may impose contextual information on the data. In my experience, conducting online interviews allowed me to connect with respondents in a more flexible way, in which I could, in effect, ‘slot in’ to the daily routines of potential participants as they went about their digital practices (e.g., remote working, social media scrolling).

However, my use of online interviewing was also characterised by chaotic and unexpected experiences that provided contextual information. For example, I had respondents suddenly share their screen to share a map of Dublin’s EV charging network and highlight the areas that were lacking. In addition, I had respondents who used the chat function and screen-sharing function to highlight a relevant comment or post they had seen on social media. On one occasion, a respondent from the private sector presented a PowerPoint of some of the work his organisation had been doing. These unexpected affordances shaped the outcomes of my research, specifically by demonstrating the centrality of digital platforms in shaping not only my methods but also to the ways in which EV users survey and engage Dublin’s EV charging scene. In the context of platform urbanism (see: Barns, 2019), another benefit of my use of online interviewing relates the ways respondents can use the screensharing functions to guide me through real-time maps of Dublin's EV charging network, which highlighted and helped them explain why some geographical areas work while others do not. In addition, features such as the chat function enabled respondents to post relevant comments, material, and resources during the interview. As a result, new technical openings emerged that empowered respondents to shape the research in meaningful ways. Given the expansion in screen capturing and recording tools on remote working platforms, methods such as screen sharing could help with what Fields, et al. (2020) describe as studying platform urbanism outside of the black box, which moves beyond an analysis of "the proprietary nature of algorithms, the secrecy of corporate ownership structures, and the emphasis on confidentiality and privacy" (p. 462) towards a type of method which emphasises "tracing, counter-mapping, and proxying as approaches that do not privilege the revelation of visibility so much as potentiality, slipperiness, and movement (p. 462)." I pay closer attention to this surprising aspect of my work in more detail in Chapter 7.

For now, I argue that this aspect of online interviewing raises interesting methodological questions because functions such as screen-sharing move beyond the individual accounts traditionally elicited in interviews to provide recordable and verifiable data points from multi-media sources produced outside of the interview process. I argue that the presence of this multi-media alters the spatio-temporal rhythms of interviewing insofar as content produced in another time and space can be enrolled into the interview process. Thus, online interviewing has the potential to, as Ruppert et al. (2013, p. 36) describe it, 'reassemble' the interview method whereby "… digital visualization now becomes a means of showing how 'excessive' information can be reduced to a form in which it can be meaningfully if partially, rendered for interpretation." In short, the data is shaped by a wider range of sources. However, this element of online interviewing is not always beneficial to research outcomes. In this regard, I now turn to examine some of the limitations of my investigative method.

3.6 Limitations

Over the course of this chapter, I alluded to the limitations of my investigative method, particularly in the context of its digitally immersive nature. In this section, I briefly reflect on four key limitations. The first limitation relates to the parameters of digitally immersive research. There were technical limitations that restricted some of the interviews' durations. For example, my institution did not have a license for the telecommunications software Zoom. When respondents only had access to Zoom there was a 40-minute limit on the meeting. There were also disadvantages to not sharing a physical space with research participants. Adams-Hutcheson and Longhurst (2017) argue that online interviewing reduces the chance of emotional and affective encounters because researchers and respondents do not share a range of senses. This dynamic may have prompted me to miss social cues that would have helped me to develop areas of inquiry. Seen in this light, online interviewing may not be appropriate for subfields in human geography, where physical interaction is essential, for example, to build rapport between participants (e.g., emotional geography).

The second limitation relates to access to respondents. There were some organisations that I failed to access, particularly in the context of public sector actors, where, in several cases, prospective participants would not respond to my efforts to contact them. This limitation is reflected in asymmetries within the numbers of the different respondent groups. A reason that goes a long way to explain my lack of access to public sector respondents, I argue, relates to a general culture of risk aversion in public sector organisations in Ireland. This is a theme that runs through my analysis. For example, I had one meeting with a public sector actor who worked with an energy regulator and despite having agreed to an anonymous and confidential interview, changed his mind at the outset of the meeting and refused to be recorded. However, the public sector actors I did interview were among the richest in terms of the quality of the data, which I argue is reflected in the overall analysis.

The third limitation relates to the barriers Covid-19 placed on my research design and activities. The pandemic arrived approximately seven months into my PhD programme. Part of my initial plans for my methodology related to ethnographic work with EV users by engaging in what Cresswell (2012, p. 645; see also Butz & Cook, 2019) describes as ‘mobile methods.’ My plan was to participate in ‘ride alongs’ with EV users and attend EV owner group in-person events to gain a sense of the challenges they face in real-time. Moreover, the public health situation restricted my ability to witness some of the work that private and public sector respondents were doing first-hand. For example, Respondent 45 had worked on retrofitting internal combustion engines (ICEs) and, throughout the interview, noted that if I could visualise the work he had been doing, it would help me understand his process. These elements did not undermine the project as-a-whole but may have brought the research outcomes in different directions.

The fourth limitation reflects general changes within the EV landscape across a variety of scales. My fieldwork was conducted in 2021 with a view to completing my writing in 2023. Within these two years, changes will have occurred that alter the plans, motives and innovations underlying the turn to EVs. For example, since my primary research took place, the Irish Electric Vehicle Owners’ Association (IEVOA) opened up its membership to private organisations and renamed the group the Irish Electric Vehicle Association (IEVA). Another example relates to the establishment of Zero Emission Vehicles Ireland (ZEVI), which launched in 2022. ZEVI is a public office “… charged with supporting consumers, the public sector and businesses to continue to make the switch to zero-emission vehicles (Government of Ireland, 2023b).” There will be some key organisations which did not operate at the time of my fieldwork. However, my interview data provides a snapshot of a crucial period of development in Dublin’s EV sector. In addition, I sought to triangulate my interview data with up-to-date secondary data when possible.

3.7 Conclusion

In this chapter, I outlined my investigative method aimed at answering my central research question: 'How do alliances of public-private actors and EV drivers assemble, mobilise, and drive efforts to decarbonise Dublin's transportation sector?' I highlighted key aspects of my approach, including reflections on my overall methodology, which aims to shed light on the structures, agency, relationality and discourses of EV users and public and private sector actors. In addition, I charted out the finer details of my primary and secondary methods before moving to discuss my use of a 'digitally immersed research methodology'. Overall, I argued that this digitally immersed approach had advantages and disadvantages that provoked me to practice novel research choreographies, sampling strategies, and interview practices that shaped the outcomes of my research. Finally, I outlined some limitations of my methodology. In the next chapter, I discuss my core results in the context of my research questions, conceptual framework, and methodology before moving on to my analytical chapters.

Chapter 4: Critical Urban Transition Studies in Question (I)

4.1 Introduction

In the previous chapter, I summarised my investigative method to explain my approach to data collection and fieldwork. I outlined the ways in which the Covid-19 pandemic prompted me to pivot to online interviewing and how this pivot created what I described as new openings and pressures in the field. I argued that my use of a suite of digital devices and platforms constitutes a 'digitally immersed research methodology' that creates new instabilities, performativities and unexpected affordances in the field that have shaped my overall research practices and outcomes in chaotic but instructive ways.

In this chapter, I turn to my research findings. From March 2022 up until the time of writing, I conducted a detailed analysis of my interview transcripts. I argue there are four core findings to highlight that shed light on the configuration failures identified by respondents, which I examine in remainder of this thesis. First, Dublin's EV project has produced '**inadequate infrastructure**' that constrains the objective of decarbonising the city; second, the EV project is underpinned by '**incoherent imaginaries**' regarding the so-called environmental reason for adopting, using, and expanding EVs; third, the EV project was shaped by '**inconstant and insufficient interventions**' by the public and private sectors; and fourth the EV project gave rise to '**imaginative and iterative**' responses by users. In this chapter, I begin to explore the utility of what I have referred to as 'critical urban transition studies' (CUTS) by drawing upon the multi-level perspective (MLP) and urban political ecology (UPE) to examine two core findings: 'the inadequate infrastructures' that constrain the objective of decarbonising the city and 'the incoherent imaginaries' regarding the so-called environmental reason for adopting, using, and expanding EVs. My aim here is to shed light on the less noticeable connections between the technological trajectory of Dublin's EV project and the ecologies underpinning it.

I organise the rest of this chapter as follows. In Section 5.2, I briefly explain the origins of Dublin’s turn to EVs to set the scene for the subsequent analysis. In Section 5.3, I draw from the multi-level perspective (MLP) to investigate the first core finding: ‘the inadequate infrastructure’ that constrains the objective of decarbonising the city. I examine the experimental forms and geography of the initial efforts to build an EV charging network at scale in Dublin through a pilot scheme known as ‘the EV pilot project’ before highlighting efforts to move beyond the pilot. In Section 5.4, I utilize urban political ecology (UPE) to analyse the second core finding: ‘the incoherent imaginaries’ regarding the so-called environmental reasons for adopting, using, and expanding EVs. I focus on how EV users enrol socio-natural imaginaries in ways that shed light on the contradiction, conflicts and tensions underlying Dublin’s turn to EVs. Finally, in Section 5.5, I round off the chapter with some concluding comments.

4.2 Background

In 2009, the Irish government signed a memorandum of understanding (MOU) with the automobile firm the Renault-Nissan Alliance and the semi-state energy company, the Electricity Supply Board (ESB), to take the first steps toward establishing an EV market in Ireland (Oireachtas, 2009a). At the time, Ireland’s Minister for Communications, Energy and Natural Resources, Eamon Ryan, was keen to market Ireland as a “test-bed, particularly in relation to network infrastructure development (Oireachtas, 2009b).” He argued that EVs would provide “a major opportunity for Ireland both in terms of our [climate] targets and more generally in relation to the economic impact of electric car development” (Oireachtas, 2009c). From the inception of Ireland’s EV market, the Irish government positioned the turn to EV as a means to experiment, decarbonise and grow the economy. This emphasis on ‘green growth’ still echoes through Ireland’s approach to the EV project today. As the Irish government’s ‘Electric Vehicle Charging Infrastructure Strategy’ states, “[the strategy] will future proof public supports as well as private investment and assets and will allow employment and economic opportunities to be identified and maximised” (Department of Transport, 2022, p. 21).

At first glance, the shift towards the expansion and use of EVs in Dublin appears as an ideal decarbonisation model for the Irish state and automobile firms because the project reinforces orthodox commitments to economic growth in Ireland while keeping the city's individualised and hypermobile transportation system intact. The Irish government has sought to grow the sector by creating an investment friendly landscape through a range of grants and tax breaks for automobile and charge point operation (CPO) firms. In addition, public institutions such as the Sustainable Energy Authority of Ireland (SEAI) have run several EV booster campaigns to improve public perception of the technology. State supports have been central to expanding the accumulation prospects of the EV market. In other words, the state's approach has been anything but laissez-faire; spending vast amounts of public resources to stabilise, nurture, and protect the accumulation regimes underpinning the shift to EVs in Dublin. It should come as no surprise, then, that several indigenous and foreign firms have considered Dublin a target city to expand their operations: UK firms such as SSE Airtricity and Ubitricity; German consortiums such as Ionity; and Irish firms such as ESB ecars and EasyGo have all rolled out a patchwork of nascent infrastructure models across the city (e.g., different standards, tariffs, speeds, locations). Dublin has become a frontier for 'sustainability' innovation, experimentation, and competition.

Yet, over a decade since the MOU was signed, several problems still exist in the city's EV project. My aim in this chapter and the next chapter is to develop an understanding of what's been taking place and to do so by exploring the utility of what I have referred to as 'critical urban transition studies' (hereafter, CUTS). The chapters contribute to scholarship on so-called 'transitions' in urban areas. I argue that, if something akin to CUTS can provide explanatory power, it must draw on and combine elements of the multi-level perspective, urban political ecology, and Marxian approaches to urban development. All three of these bodies of work already influence scholarship and research on urban transitions. Hitherto, these approaches tend to be siloed; I argue there is scope to bring them into conversation. I now turn to the multi-level perspective to examine my first core finding.

4.3 The multi-level perspective & Dublin's inadequate EV infrastructure

A critical approach to urban transitions must engage in one way or another with the multi-level perspective (MLP). In this section, I focus on the first of my core findings: that an *inadequate infrastructure* constrains the objective of decarbonising the city. The MLP predicts that a city in transition, as Dublin appears to be defined, would not have an adequate infrastructure given that the turn to EVs is at an early stage in terms of the technological trajectory and diffusion of EV technologies. Niche innovations such as EV charge points are expected to experience "teething problems" (Geels, et al., 2008, p. 522) and "typically face an uphill struggle against existing systems" (Geels, 2012, p. 472). In this regard, the success of niche innovation is typically understood in the MLP through its ability to integrate into ('fit-and-conform') or disrupt ('stretch-and-transform') an existing technological regime (Smith & Raven, 2012). To bolster the chances of success, niche action often emerges within 'protective spaces' – such as research and development laboratories, subsidised experiments, or 'regulatory sandboxes' (see: Lopolito et al., 2011; Hermans et al., 2013; Geels, 2012) – where innovations are expected to "…grow and mature through gradual experimentation and learning processes performed by producers, researchers, users, as well as governmental and other organizations" (Lopolito, et al., 2011, p. 28). As I now demonstrate, the MLP can go a long way to explain Dublin's trajectory. I focus on four issues.

4.3.1 The experimental form of the EV pilot project

A crucial starting point for understanding developments in Dublin concerns the earliest efforts to build a large-scale publicly accessible EV charging network in Ireland via the pilot study known as 'the EV pilot project' (for project summary, see: ESB Networks, 2018a; 2018b). The pilot was conducted by ESB ecars and ESB networks in coordination with the Commission for Regulation of Utilities (CRU) and ran from 2011 until 2018 through various iterations.[1] According to

[1] I note that the pilot ran from 2011 through 2018 but the role of ESB and CRU in shaping the EV project in general can be traced back as far as 2008 via the establishment of 'inter-departmental

ESB Networks (2018b, p. 4), the study carried out "…a large-scale trial development of electric vehicle charging infrastructure to assess the impact that the electrification of transport will have on the electricity network." The pilot was *publicly funded* through research grants made available to the ESB by the state, via the EU Trans-European Transport Network (TEN-T) and Interreg funding (ESB Networks, 2018a, p. 7), and by the recovery of costs from electricity users via Distribution Use of System (DUoS) charges and the Public Service Obligation (PSO) levy (CRU, 2017, p. 1). By publicly funding the infrastructure, ESB ecars provided the service to EV users – at that stage, overwhelmingly a high-income group – free-of-charge for the duration of the pilot.

Per my interviews with respondents in 2021, the EV pilot project deserves attention because it set in train developments and cemented features that still shape the EV project. Respondent 72, who worked closely on the pilot study, offered some insights into the challenges he faced:

> "…we got some money from the regulator to run the pilot […] We had to effectively do a bit of research, so we could claim money back. So, we had to produce a big report that was available to share effectively. We also got some money from the EU through a thing called TEN-T funding and Interreg funding […] it was like VHS and Betamax at the time […] When video came out first, there were two standards, and people didn't know which one was going to win. VHS won out, and not because it was better than Betamax, it was just more people went with it […] we were the very same at the start. […] One of the issues was a lot of startups at the beginning […] just collapsed after a while. So, you were trying to figure out who to go into business with because they might not be around…" (Respondent 72, semi-state representative)[2]

agency taskforce to progress the framework for the deployment of electric vehicles in Ireland' (Oireachtas, 2009d).

[2] I return to the issue of standards and specifications underlying EVs in Chapter 6.

Per Respondent 72, the early stages of developing Ireland's EV charging infrastructure were deeply experimental, marked by what MLP contributors Lin & Sovacool (2020) refer to as 'inter-niche competition'. It was a speculative yet inherently risk-averse approach to innovation, whereby the actors involved had to carefully survey the scene and, as Respondent 72 noted, 'figure out whom to go into business with.' The upshot of these experimental dynamics was a slow-moving project that frustrated EV users. Thus, according to Respondent 48:

> "So, ESB ecars, the way I view it […] was a large-scale pilot to see what is required to get all these chargers in and what sort of chargers' work. And from talking to some of the EV charger manufacturers, they got a lot of learnings out of it […] The problem with it, then, was, because this was done on such a scale, people saw [the EV pilot project] as the de-facto rollout of EV chargers. And the people expected it to be rolled out much quicker." (Respondent 58, energy sector representative)

I argue Respondent 48's view resonates with MLP contributors Lawhon and Murphy (2012, p. 357), who urge scholars examining niche action to expect slow movement, because "system innovations […] take time to complete, often decades or more, and some are never complete." However, one consequence of the EV pilot project's slower dynamics was that the infrastructure did not expand at the same rate as EV purchases, often resulting in long queues at many charging stations. As Respondent 1 noted:

> "There was a stage up until 2015-2016 when ESB [ecars] really expanded the network […] [Since then] ESB [ecars] stopped installing any new ones, but the number of users grew a lot – a lot, a lot, a lot – compared to what it was before. We've seen some issues like […] at an electric charging station one day there was six or seven cars queuing

> […] The number of users went up so much; the downtime was still a problem.” (Respondent 1, EV user)

For Respondent 1, the inadequacies emerging from the EV pilot project were driven, in large part, by a mismatch between the growth in EVs and the underlying infrastructure. In addition, users also reported that the charge points installed by ESB ecars during the pilot were prone to breakdowns. Respondent 34 argued that the ‘buggy and brittle’ features of charge points produced a broader sense that the network as-a-whole was unreliable:

> “… Ireland was supposed to be the testbed for EVs in Europe […] that's how all the old ESB chargers ended up out there. The idea was someone looked at Ireland, [and said], ‘oh look at the size of it, look at the climate in it, this is an ideal place to test EVs and see how they work’. Then the first EVs were the first Leaf and the Mitsubishi I-miev […] because the range was so bad, you needed a charger on every corner you turned, you know, and they needed to be working […] they were just unreliable. Like you'd go to one, and it wouldn't be working, and you need it to be working because you're out of charge […] Ireland was going to be like the example for the world or Europe.” (Respondent 34, EV user)

Clearly, as Respondent 34 highlighted, how the risks of pursuing climate action via niche experiments are severe because early-generation technologies tend to be less reliable. ‘Testbeds’ can fail to meet the expectations of technology users and can embed soon-to-be redundant infrastructures. The MLP anticipates these sorts of findings.

4.3.2 The EV pilot project’s map of charge points

I argue the MLP is *also* helpful when considering a second aspect of Dublin’s inadequate infrastructure: the map of charge points. Respondents in my research consistently questioned locational decisions associated with the EV pilot project, as well as the technological character of the map itself. For example, Respondent 45 noted that ESB rolled out a network of:

> "22-kilowatt AC chargers, which are usually on public streets with limited to no marking outside them, and certainly no enforcement, meaning that they're regularly occupied […] it just doesn't make sense to use it […] It's just absurd. They're useless. Now, again, this is not a criticism of ESB, but it's getting to a point that 'put these chargers everywhere so there's something there that somebody can use' approach has stuck […] it's just a smattering of chargers […] even if they were good quality chargers, what you have to do is, you drive to the first one, and it's occupied, so then you go and drive to the second one, and it's occupied. Then you drive to the next one, and it's not working, and you drive the next one, and it's occupied, and now you're out of charge. So, you're stuck at that one until whoever's on it gets off it, and you plug in." (Respondent 46, charge point operations representative)

A key problem, then, is precisely that the network consisted of 22-kilowatt AC chargers, which presented limitations offset mainly by the fact that their installation required quite limited groundworks in comparison to the latest DC fast chargers, which require extensive and expensive groundworks. The relatively low cost of installing 22-kilowatt AC chargers enabled ESB to meet its aim of providing some degree of national coverage. For Respondent 45, the effect of these decisions lingers:

> "…it is not a criticism of ESB. It was a technology they could afford; it was the technology that was available with a small budget, they had to do the job on a nationwide scale, *but we need better now*." (Respondent 46, charge point operations representative; my emphasis).

Yet, what 'better' means, in practice, is not just about the underlying technology but also very much about the exact locations. The EV pilot project set the blueprint for future charging network designs. To the extent that the infrastructure is still incoherent, it needs to be understood as an effect of the EV pilot project's initial design. The EV pilot project's strategy demonstrated that useful innovations – 'even good quality chargers' – are insufficient if the planning and design of innovations lack what I argue is a sense of 'spatial coherence'. Respondent 2 showed me a map of charging points to highlight the following:

> "…if you look closely [at the map], there is nothing except for this one funny little thing that belongs to some golf club or something. It's an astonishing speed of 3.7 [kilowatts] […] that means charging [the EV] for the next 12 hours or something crazy like that […] So that's useless [...] Then there was another somewhere in this industrial area, John F Kennedy industrial estate […] No one was taking care of it, so it was constantly broken, vandalised basically, and there was always a queue. Then there was one in Park West, and this one is basically like a business park, so there was always someone plugged in […] if you look closely, this whole area [on the map] is basically empty. Basically [you have to drive] five to ten kilometres each time just to get a charge…" (Respondent 2, EV user).

If the marginal areas hosting charging infrastructure created frustrations for users, as Respondent 2 suggested, another problem was that charge points were frequently located at the periphery of sites. As Respondent 26 noted:

> "…you have other cases like that, where you're literally parking around the back of the garbage by the bins, or you're parking like, you know, in a train station car park, or some corner of a car park in the dark with no lights, which even for me, I wouldn't be too happy with that, but some other people, maybe more vulnerable, [it] wouldn't be, you know, it's not very inviting." (Respondent 26, EV user)

Despite the hype surrounding EVs, the marginality of the underlying infrastructure still reflects the EV pilot project's locational decisions.

Taking stock of these findings, I argue the MLP is a helpful prompt because it highlights that niche innovations aimed at breaking into existing technological regimes face an uphill struggle. Dublin's 'new energy spaces' (see: Bridge & Gailing, 2020) play out in everyday and mundane ways, just as the respondents above have noted. Yet, if a criticism aimed at scholarship engaging the MLP relates to its "spatial blindness" (Becker, et al., 2016, p. 94), the accounts above suggest that some much-needed spatial vitality can be injected into the MLP: the emerging spaces of Dublin's urban transition are characterized by struggles over decisions about technological pathways and facets such as locational decisions. The MLP suggests that 'power struggles' should be expected across multiple dimensions, such as "economic competition between old and new technologies; business struggles between new entrants and incumbents; political struggles over adjustments in regulations, standards, subsidies, and taxes; and discursive struggles over problem framings and social acceptance" (Geels, et al., 2017, p. 466). What I have tried to demonstrate here is that, although ESB pursued an ambitious programme to provide some degree of national coverage, its decisions embedded in the wider decarbonization project an infrastructure with a problematic character.

4.3.3 Struggles to move beyond the EV pilot project

The third and final issue to consider with respect to the impact of the EV pilot project on Dublin's inadequate EV infrastructure offers another opportunity to engage *but also to probe the limitations of* the MLP. With respect to engaging the MLP, I argue that scholarship therein directs attention toward the possibility and even the likelihood that niche innovations or technologies in development will falter. This is indeed a key characteristic of Dublin's move toward EVs, as comes to light with respect to the experience of 'range anxiety', which features heavily in discourses surrounding EVs and intimately connects with the substandard condition of Dublin’s charging infrastructure. As Respondent 36 noted:

> “It's not a ‘range anxiety’, it’s: ‘is the charger working? anxiety’ […] You have no idea, when you get to that charger, if it's going to be working […] If my journey is time critical, then it really is a worry if a charger I've planned on [using] isn't working, because there is [sic] very few other options to go to.” (Respondent 36, EV user)

Other respondents commented on this element of the infrastructure’s inadequacy. Yet, for Respondent 36, the issue was not so much that the technology underlying the entire infrastructure was brittle but rather that ESB ecars, which was responsible for maintaining and repairing specific nodes in the network, had neglected to do so:

> “I don't think the ESB [ecars] have done a good job. I really don't. I think they held back on repairing a whole load of chargers while they were waiting for [the] government to give them funding. They let all chargers fail and did not respond to requests for repairs […] It felt so political. It felt like they were really dragging their feet, not wanting to repair things when they were actually given money to do that originally.” (Respondent 36, EV user)

The reference here to ‘waiting for the government to give them funding’ is crucial here because it calls attention to how the EV pilot project ended in 2018.

As I have documented above, the project was rolled out by ESB ecars with a view to demonstrating that EVs could become a viable alternative to internal combustion engines. As the project neared its completion in 2018, there was sufficient evidence to suggest that the number of EVs would expand significantly, and there was interest among private sector providers in rolling out new chargers. However, the availability of free charging at ESB ecars charge points was an obstacle. As such, a question for the ESB and the government, via the CRU, was what to do with the infrastructure rolled out via government funding. Was the infrastructure to remain a regulated asset operated by the ESB on behalf of the government, or should the ESB be allowed to take over full ownership of the infrastructure and, if so, under what financial arrangement should this occur? Should the chargers remain free-to-use, or must charges be introduced? In the context of this uncertainty, while the ESB waited for the government and the CRU to decide on the approach, the chargers associated with the pilot project were neglected. As Respondent 42 argued:

> "So, ESB [ecars] were given the task, as I said, by [the] government to develop a charging infrastructure when they could see no market for it […] and after putting in the charging infrastructure, as I said, and having no idea what the service and maintenance requirement would be until you put it in because it was a first. ESB [ecars], then, and in my mind quite rightly [so], questioned the market value of that charging network and questioned the ownership because it had been, as I said, supplied by European money and been done on behalf of the Irish government […] You have to remember that a lot of the monies that arrive into ESB [ecars] happen by means of tariffs. So those tariffs are on your ESB bill […] they come from things like the DUoS system where everybody's contributing, and then you've got the Public Service Obligation (PSO) levy [...] So unfortunately, what happened was the decision went to the Commission for Energy Regulation, as it was known then […] they took 18 months to come to a decision about who owned that network and what would happen to it in the future [...] Basically, they failed, and they postponed the possibility of further investment, not only by ESB [ecars], but by leaving it in an undecided state, it also meant private industry couldn't come in and invest because they weren't sure what the outcome was going to be […] So that's actually the truth behind that period where, you know, charge

> points were left non-serviced and non-maintained." (Respondent 42, automotive sector representative)

Thus, per Respondent 42, the maintenance and repair failures in this region of the infrastructural network took shape against the backdrop of a period of faltering investment and waning interest on the part of ESB ecars as its EV pilot project ended.

I argue that explaining this element of my research findings *can* lean on the MLP given the emphases in the literature on niche innovations failing to develop and become part of a regime. The CUTS framework I develop draws on the MLP for good reason because it suggests to us that niche actions will yield an inadequate infrastructure. Failures or problems within the EV pilot project make sense and are, to an extent, expected. Moreover, the MLP framework brings to the surface some of the messy power struggles between niche innovation and technology regimes. I revisit other specific burdens that EV users experience in Chapter 6 and Chapter 7 with a view to examine in greater detail the strategies and practices that EV users pursue to help ameliorate, circumvent, or find fixes for the inadequacies they encounter.

However, I also argue that understanding this element of Dublin's drive toward EVs requires pushing the limits of what the MLP can achieve. On the one hand, the inadequate infrastructure noted by respondents exists, in part, because of what I refer to as incoherent imaginaries which stem from the ways in which economic agents driving the EV transition have always needed to try and balance (and sometimes sacrifice) sustainability with/for economic objectives. On the other hand, I argue that inconstant and insufficient interventions underlying Dublin's EV project need to be examined. Shifts from investment in the EV infrastructure to disinvestment, from intense interest to waning interest, reflect an uneven and unstable political economic context. As such, I argue that scholarship in urban political ecology and Marxist approaches to urban development need to be brought to bear on Dublin's EV transition. Critical urban transition studies can use the MLP but needs also to go beyond it.

4.4 Urban Political Ecology & the incoherent imaginaries of Dublin's EV shift

In the previous section, I utilised the multi-level perspective (MLP) to examine the inadequate infrastructure related to Dublin's turn to EVs. In this section, I draw upon Urban Political Ecology (UPE) to examine the second core finding: that the turn to EVs is underpinned by *incoherent imaginaries* regarding the so-called environmental reasons for adopting, using, and expanding EVs. If the MLP directs attention to the ways in which niche innovations users "…face an uphill *struggle* against existing systems" (Geels, 2012, p. 472; my emphasis), I argue that CUTS must bring to the surface the nature-society relationships that underlie those struggles. A UPE approach can help to shed light on "the regulation of our relationships with nature in cities" (Keil, 2003, p. 729). My goal is to explore how CUTS can move beyond a focus on how low-carbon infrastructures emerge in urban environments towards an approach that can tease apart the complex, and at times obscure, socio-natural processes that shape the decarbonisation process. I explore how actors driving the shift to EVs in Dublin enrol socio-natural processes in ways that make them explicit and obscure. My aim here is to treat nature as 'lively' in the production of urban change with a view to illuminating the contradictions, conflicts, and tensions of Dublin's shift to EVs. As Harvey (1993, p. 2) suggests, "the contemporary battleground over words like 'nature' and 'environment' is more than a matter of mere semantics, but a leading edge of political conflict." The shift to EVs suggests that a novel urban environmental politics is emerging that demands attention.

One key consideration here is that efforts to decarbonise transportation in Dublin emerge in the context of a city dominated by car ownership. Around two million people, or 40 per cent of Ireland's population, live in the Greater Dublin Area (CSO, 2022a).[3] According to the census, approximately 50 per cent of Dublin's

[3] The Greater Dublin Area consists of the counties: Dublin, Kildare, Wicklow, and Meath

population commute using an internal combustion engine (CSO, 2016a) and 78 per cent of households own at least one vehicle (CSO, 2016b). Dublin's transportation system is characterised by its interlinkages with a wider global 'system of automobility', in which cars are "*the* major item of individual consumption after housing" (Urry, 2004, p. 26; my emphasis); and are "integral to the privatisation, individualisation and emotionalisation of consumer society as a whole" (Gilroy, 2001, p. 89). The comments from respondents below shed light on elements of Dublin's urbanisation that reflect and reproduce the city's unique system of automobility:

> "[Dublin has] 100 years of planning that doesn't lend itself to public transport. That's not going to be unwound in 10 years or 20 years […] Ireland is just one big sprawl, you know, like urban Dublin goes as far as Mullingar. Like Maynooth is part of urban Dublin…" (Respondent 59, automotive sector representative)

> "…when I left Bulgaria 21 years ago, they just started building a metro network in Sofia […] They built a humongous metro network in 20 years. In Ireland, there's still talk of building one line of the metro." (Respondent 38, EV user)

> "I would not cycle Dublin. I even hate driving in Dublin with the cyclists. It terrifies me. The lanes are narrow. [Cyclists] are sharing [lanes] with the busses, and I'm like 'Jesus'." (Respondent 17, EV user)

> "[I am] essentially a sales rep, I have to go to multiple sites and places every day. They could all be very last minute. So, I need to be able to go and move whenever I choose and in a very fast and direct manager. Public transport doesn't suit my lifestyle at all…" (Respondent 18, EV user)

> "…there is quite a bit of public transport, we have got the DART beside us, we have got busses, but there is [sic] still tens of thousands of private cars […] We are not that far from the city centre. So, that is a reality. People like their cars. The car represents freedom of mobility…" (Respondent 3, EV user)

In sum, the interwoven legacies of urban planning, labour market changes, and a deep-seated 'car culture' have entrenched automobility in Dublin's transportation system. Irish development is defined, at least in part, by automobility. As I now demonstrate, a UPE approach can help to explain how the turn to EVs in Dublin interacts with this wider system of automobility.

4.4.1 A socio-natural imaginary

There is evidence that respondents care and think about the ecological impact of driving an EV. They see benefits. I identify six distinct benefits highlighted by respondents that demonstrate the diverse ways socio-natural processes become enrolled into Dublin's EV project.

First, the most obvious benefit is the role of EVs in decarbonisation. EVs *do* have decarbonisation potential.[4] According to Respondent 9, her concerns over climate change were a key factor in prompting her adoption:

> "…my car was coming to the end of its life for my use and, you know, [I thought] 'what route am I going to go down?' Well, I'd rather go down a route where there's more of an environmentally friendly use. There's not this reliance on fossil fuels. I'm able to have an energy supplier that uses renewable energy. Well, to me, it seems like a no-

[4] A criticism aimed at EVs is that the carbon emitted during the production and disposal of the vehicle as well as within the emissions from the fossil fuels burnt to produce the electricity, outweighs any reductions in tailpipe emissions. However, Knobloch et al. (2020, p. 442) found that "…current model EVs […] have lower life-cycle emission intensities than current new petrol cars […] in 53 of 59 world regions, accounting for 95% of the global road transport demand […] Relative differences range from being around 70% less emission intensive per vehicle-kilometre (in largely renewable- and nuclear-powered Iceland, Switzerland and Sweden) to be 40% more emission intensive (in oil-shale-dependent Estonia).

> brainer. I mean, clearly, climate change is an issue, and if there's something that I can do to contribute to combating climate change, I'm happy to do so. I also get to drive an awesome car, too. Like, if it was a shitty car, I'd probably be less inclined to do it. When you get to drive a car like a Tesla, it's amazing." (Respondent 9, EV user)

Per Respondent 9, EVs provide an alternative for individuals seeking to drive in more 'environmentally friendly' ways. There is a sense that users understand the earth's climate as a 'global commons' and take additional measures to protect it (e.g., selecting an electricity supplier that uses renewable energy). They view their consumerism as a potentially powerful tool in shaping socio-natural transformations. Yet, entangled in EV users' appeals to contribute to society's collective ecological well-being are a collection of personal gains.

The second benefit highlighted by EV users was air pollution. For example, Respondent 2 noted how his EV use heightened his awareness of Dublin's poor air quality:

> "… if I am ever stuck in traffic, and that happens quite a lot in Dublin, you can smell all the diesel around you, you know, especially when you are so used to driving an EV, and there are no emissions whatsoever. Of course, there are emissions wherever electricity is provided. But, in that spot where you are sitting, there is [sic] no emissions, there is no smell, no noise, no vibrations. Then you get stuck in the traffic, and you take one whiff, and oh God, that starts you thinking, especially when you have kids." (Respondent 2, EV user)

For Respondent 2, the emissions produced in electricity generation were incidental to the positive ecological benefits developing 'where you sit'. The positive socio-natural transformations of driving an EV were encountered locally.

A third benefit signposted by EV users in their reasons for adopting, using, and expanding an EV related to their experiences with noise pollution, which again is a localized matter. Per Respondent 28, driving an EV is:

> "…almost like you are rediscovering a whole new ecosystem because you don't hear the engine gears anymore. So, everybody thinks that driving an EV is a silent experience, but it's actually a lot more noise that you're aware of because there's no dampening from the engine. So, you hear more noise from the road […] it's almost like a whole new experience that you never had access to, and that was very appealing to me." (Respondent 28, EV user)

A key point here is that individuals develop a new understanding of their relationship to nature and the environment through their EVs. A shift, even a subtle change, in how automobility interacts with the so-called natural world can have effects on the society-nature relationships that characterize urbanism.[5]

A fourth benefit identified by users concerns the kinaesthetic peculiarities of EVs. Consider Respondent 3's experience:

> "Everything is so comfortable. So, I have a choice to drive to Tralee in my Nissan Leaf or in my mother-in-law's Renault Clio […] the electric [Nissan Leaf] is much more comfortable, and it has no gear change, and it is silent. You hear the silence going down the motorway. It is silence; there is no vibration. The experience is significantly better. There is no doubt about it […] Why would you buy something that is clunky and vibrating when you can have a faster car, a higher performance car, that is just as beautiful and glides along

[5] Indeed, understanding noise pollution can help to explain the society-nature relationships that characterise cities. Recall the transformations, which occurred from reduced traffic pollution during the Covid-19 pandemic where reports highlighted the return of the 'bird song' in urban environments (see: Stokstad, 2020). As Domhnaill, et al. (2022, p. 570) suggest, "…environmental noise is an important feature of daily living in cities and urban areas, robust evidence on this issue is necessary in a global context of increasing urbanisation."

> the road? […] You pay massive money for a comfortable Rolls Royce or Bentley; people pay for the comfort.” (Respondent 3, EV user)

According to Respondent 3, then, the willingness of individuals to purchase an EV can be framed around the kinaesthetic functions of the car. In other words, the decarbonising city produces and draws upon a different type of rhythm and feel. For mobilities scholars, such as Sheller (2004), ‘feeling the car’ is a central aspect of driving that keeps the ‘system of automobility’ intact. EVs reproduce that system, albeit with new standout features – heavily marketed by OEMs – that could boost sales.

Along similar lines, the fifth benefit identified by respondents related to the technicalities of EVs. For example, Respondent 15 suggested that his reasons for adopting an EV primarily related to the technical affordances and performance of EVs as opposed to wider concerns over the environment:

> “Like for me, it is like electric cars are not about the environment, really. They just make more sense. They are better cars to drive, but governments are sorting out where the electricity comes from, and there is [sic] plenty of people worrying about that already. So, I do not particularly mind where my energy comes from […] I do not feel like I should be lobbying for electricity to go greener. I think it is going to go greener anyway.” (Respondent 15, EV user)

Respondent 15’s experience sheds light on how the so-called environmental reasons for adopting are often secondary to the ‘common sense’ discourses surrounding EVs and associated technologies. EVs are considered as much the so-called ‘smart’ travel option as they are the ‘environmentally friendly’ one. I argue the smart discourses surrounding EVs emerges, in large part, from the digital technology entangled in the experience of adopting, using, and expanding EVs, a point I revisit in Chapter 7 with a view to trouble this smart framing.

The sixth benefit related to what Respondent 41 described as the ‘emotional piece’ driving the shift to EVs. He highlighted how a new discursive framing couched in notions of ‘smart’ helped to expand the use of EVs:

> “We have left out one key piece of the motorcar, which is emotion […] I lie in bed in the wintertime, and I send my car a message from my mobile phone, and I say, ‘please heat yourself.’ It does that well: it is connected to my charge point, which is on my home, which is connected to my solar array, and my storage battery. So, I use the power I created myself to defrost and heat my car. So, I leave in the morning in my short sleeves. While my neighbours who are in their Range Rovers are scraping ice off the window like Neanderthals […] I feel like I am smart, I am connected, I am part of this new economy, I am part of this new modern world people are talking about. The guy in the Range Rover, is not […] That emotion of ‘I am smart, the car is smart and connected to a smart information system’ […] might actually win out over science, education, you know, *uncoordinated* thinking, which is a mind-blowing possibility.” (Respondent 41, automotive sector representative: *my emphasis*)

According to Respondent 41, adopting an EV entails a larger emotional and cultural shift in which EV users feel as though they are at the new frontier of technological development. For Respondent 41, this emotional attachment ‘might win over the uncoordinated thinking’ that, to date, has defined the EV project in Dublin.

In sum, the process of decarbonising Dublin is bound up with socio-natural dynamics that extend beyond efforts to reduce carbon emissions in urban environments. Concerns over air quality and noise pollution, as well as some of the more ‘emotional’ components of EVs, such as what Sheller (2004) refers to as “feeling the car”, help to explain why individuals adopt, use, and expand EVs. Yet, the socio-natural transformations foregrounded by EV users tend to be localized, entangled with their encounters and experiences of a pristine ideal of the so-called natural world. Overall, what we find is an imaginary that is attuned to the socio-natural, albeit in a range of ways.

4.4.2 An imaginary to obscure ecology

Per the above, my research has revealed an imaginary that is attuned to the socio-natural; an imaginary that points to some of the ways EVs alter what Keil (2003, p. 729) refers to as the "regulation of our relationships with nature in cities." It is, however, by no means the only imaginary expressed by EV drivers and the wider EV economy. My focus here is on the ways in which some of the actors driving the shift towards EVs in Dublin deploy an imaginary about EVs that undermines any of the purported environmental or socio-natural benefits mentioned above. I explore how actors add their voice in support of an EV project designed around hypermobility for the sake of reducing 'range anxiety' and charging times but do so in ways that produce far-reaching and often destructive ecological transformations. I have three points to make.

The first point relates to the push for longer-range batteries, which have become a prominent feature of Ireland's EV market. Since 2012, the advertised range of new EVs available in Ireland has roughly doubled.[6] For Respondent 1, this shift was closely associated with legacies of 'range anxiety', born out of the apparent limitations of early-generation EVs:

> "Manufacturers tried to sell the early EVs by saying, 'the average commuter is doing 30 km a day […], and our car is doing 100 km. So, it is a perfect commuter'. [However,] a lot of people were thinking, 'oh, what if I need to go from one side to the other side of the country overnight?' It is crazy, because no one actually does that […] So, there

[6] Consider that in 2012 the most popular EV, the Nissan Leaf, had a 24-kWh battery with an advertised range of 160 kilometres. In contrast, the Volkswagen ID.4 was the most popular EV in 2022, with a 52 kWh – 77kWh battery and an advertised range of 353 to 525 kilometres, depending on the model (SIMI, 2023; Nissan, 2012; Volkswagen, 2023).

> is still range anxiety, but it's going away because [the] cars are getting [a] bigger and bigger range…" (Respondent 1, EV user)

Per Respondent 1, the conditioned expectations individuals have of automobility conflicted with the battery ranges of early-generation EVs; drivers expect seamless travel and a wide geographical reach even with the relatively low commuting distances of 14.7 kilometres in Ireland and 9.8 kilometres in Dublin (CSO, 2016c). Other EV users, such as Respondent 14, noted how their decision to adopt an EV hinged on the emergence of longer ranges in the Irish automobile market:

> "…we've got a [Kia] E-Niro, which, before grants, is €51,000 […] I had been sort of looking at [older EVs] with a lower range and thinking, '[I am] not sure if I can justify having a car with such limited range.' So, it was only because, financially, it became viable for me that I could go for [a new EV] that actually had the [long] range on it that made me feel comfortable with the purchase as a first-time EV buyer." (Respondent 14, EV user)

Put differently, longer ranges go a long way to boost consumer confidence in EVs. Yet, under closer examination concerns over battery ranges are distinctly imaginary. For example, Respondent 11 asked:

> "… can I get as far as [my sister] in one go, if you like, without having to charge? […] [my sister] lives in Northern Ireland […] When I was buying the car, that was my test case. I can. *Well, theoretically, I can. I haven't tried it yet."* (Respondent 11, EV user: my emphasis)

This desire to 'theoretically' cover long distances, Per Respondent 11, was a consistent feature of my interviews, even though EV users recognised that the push for longer ranges exaggerated the geographical reach that drivers require. Consider Respondent 15:

> "[Individuals construct] the whole scenario of like, 'what if in an emergency I have to drive to Belfast, and drive home, and then, drive to Belfast again?' […] People come up with these ridiculous scenarios […] They pose different questions and different standards on electric cars than they do for normal cars, and then they don't generally follow through with the logic of what they're saying." (Respondent 15, EV user)

What we can see here is that the desire EV users express for longer ranges emerges not so much out of long or hectic travel patterns but from individuals envisioning their capacity to cover long distances at speed and with ease. A crucial consideration in all this is that battery production is among the highest cost drivers for EV manufacturers, which means that the price of a new EV tends to relate to the size of its battery and thus, the length of its range. Larger batteries drive up the material throughput of EVs; increase demand on lithium refineries; and have costly R&D expenditures (see: Stringer & Park, 2021; Ewing & Krauss, 2023). In short, the larger the battery the more resource and capital inputs that go into producing it. For Respondent 3, this change in relationship between range and costs fundamentally alters the dynamics of automobility:

> "You need 200 kilometres, or the car is virtually useless. It's useless for 10% of your requirements, and therefore, it doesn't meet your requirements […] You can have as much range as you want it is just a function of cost. How much do you want to spend? And that is a new narrative, a new economic narrative because up until now, range depended on how much petrol you were willing to buy and the price of petrol. Which is a low-cost item. Now range will be a high-cost item. Lithium-ion batteries are an expensive item, they're getting cheaper, but they'll always be an expensive item. So, if you want range, you'll have to work out the economics of it and say, 'okay, do I really need it?' […] it is just a function of money." (Respondent 3, EV user)

I argue that the comments from respondents above demonstrate what mobilities scholarship refers to as 'motility, or "…the potential for movement" (see: Urry, 2007, p. 38; Featherstone et al., 2005; Kaufmann et al., 2004). Seen in this light, a key ideological component underpinning automobility relates not so much to actual travel itself but to "…the capacity to move spontaneously and independently (Featherstone et al., 2005, p. 65)." The push for longer ranges emerges against this imagined mobility whereby users envision and demand a capacity for seamless transportation. However, if users enhancing motility 'is just a function of cost', per Respondent 3, then questions of economic power and class demand attention. As Kaufmann, et al. (2004, p.754) suggest, "Motility as it relates to goods, information and people, is differentiated in terms of access, competence and appropriation, where the local and geopolitical context is emphasized as a fundamental consideration […] Motility represents a new form of social inequality."

My second point relates to the problematic and destructive ecological transformations obscured behind these efforts to increase battery ranges. By almost doubling the capacity of EV batteries, automobile firms have intensified efforts to mine materials such as lithium and cobalt in the global south.[7] The upshot has been what Jerez et al. (2021) describe as 'the colonial shadow of green electromobility' in which "the expansion of lithium demand [alongside a demand for other critical raw materials], […] promoted by the new green economy and its CO2 reduction policies in the Global North […] has been generating socio-environmental damages and water injustices in the Global South (p. 2)." In this regard, I ask: What exactly did respondents have to say about Dublin's position within 'the colonial shadow of green electromobility?'

[7] In fact, one report from UC Davis found that limiting the size of EV batteries to 35 kWh in the US alone, while maintaining the country's current levels of car ownership, would reduce global lithium demand by approximately 42 per cent (Riofrancos, et al., 2023). Battery sizes matter.

Among the respondents who engaged with this component of the research, there was a tendency for them to conceal the extractivist regimes underpinning the shift towards EVs. For example, Respondent 3 argued that because lithium deposits are widely available across the globe, the geography of mining can be reshored to global north locations:

> "Well, lithium is all over the place. Lithium is in the sand. It is everywhere […] it is easy to find lithium. Elon Musk has bought 100,000 square miles in the Arizona desert that has sand with lithium in it, and you extract then put back the sand. It is not a problem at all." (Respondent 3, EV user)

Other respondents recognised that the turn to EVs had intensified extractivism but rejected the idea that economic agents in the global north held responsibility for any negative socio-natural transformations occurring as a result. As Respondent 4 noted:

> "Obviously, the practices for mining those [critical raw materials] can be pretty dodgy. I don't see that as my personal responsibility. I see that as a kind of a government one. Not even our government, but the governments in those countries […] They are the people that can do more about that…" (Respondent 4, EV user)

In contrast, respondents who did accept a degree of responsibility argued that extractivism was a necessary evil underlying the decarbonisation process. Consider Respondent 12:

> "Well, I think at present [extractivism] is the only way out […] but I have ultimate faith in technology, that there'll be a nano nano nano or something that will be produced to replace [current battery technologies]. That it is not beyond the wish of man or woman […] I tried to counterbalance my bad habits with planting trees, we planted

> hundreds of trees […] So I hope that's my kind of apology for sending people down to mine […] It's a desperately dangerous practice for [the miner], and it's a financial resource for [firms].” (Respondent 12, EV user)

Respondent 12’s comment sheds light on the technological solutionism featuring in decarbonising discourses that “presumes rather than investigates the problem that it is trying to solve… (Morozov, 2013, p. 6).” Seen in this light, not only is a silver bullet solution only around the corner, but the negative effects of technological shifts are an unfortunate necessity in the efforts to democratise the so-called benefits of decarbonisation. Clearly, the imaginaries deployed by actors in their efforts to reduce ‘range anxiety’ not only seek to maintain a hypermobile transportation system but also (re)produce deeply unequal structures of economic power. The colonial shadow of green electromobility is obscured via a politics of erasure that denies the responsibility and, at times, the existence of extractivist regimes. The environmental politics of EVs yield dominant and oppressed positions within the uneven geographies of global capitalism with far-reaching and destructive ecological transformations.

The third and final issue to consider here concerns efforts to reduce charging times via the installation and expansion of high-speed charging infrastructure. As I discussed in Section 5.2 above, Ireland’s EV pilot project rolled out a charging network consisting of single-unit and dispersed 22-kilowatt AC charge points. By 2021, EV users, such as Respondent 6, were calling for faster DC chargers to be rolled out.

> “…my attitude would have changed quite a bit. I think what we need is fast charging dotted well away from big [urban] centres […] If I’m away from home and I’m fully charged […] then the thing is getting back home, if I’m on a very long drive, that might only take a 15 minute charge on a very high speed charger say 100 kilowatt hours […] We actually need very high-speed chargers scattered all down

> across motorways, all the main motorways in the country […] every 15 to 20 miles, say, you have a really fast charger, and that will enable you to branch into other parts of the country. There's no point in putting fast chargers in *bótharins* [small country roads], because who needs them there?" (Respondent 6, EV user)

One reason that explains the 'changing attitudes' of EV users, per Respondent 6, is that long-range batteries require a different type of charging infrastructure built around high-speed DC charge points and located outside of cities along the major routeways. In fact, EV users noted how the existing public charging infrastructure was lacking, because the charging speeds available could not meet the demands of newer long-range EVs. Consider Respondent 28's comment:

> "The infrastructure is way behind […] The problem here is that there is just not enough, and when you get to one, it is already in use and those chargers, even very soon for budget cars, they won't be fast enough to accommodate the same use that you would make of your EV as if you had a petrol car […] What you would do in a medium-sized battery [powered EV is], you drive an hour and a half, you stop for 30 minutes, you top up enough to drive another hour and a half […] If we had 150 kilowatt hour chargers actually deliver that kind of output, then you will be stopping maybe for 20 minutes or 35 minutes, every three hours." (Respondent 28, EV user)

According to Respondent 28, the challenges presented by a low-speed network were no longer isolated to luxury EVs because 'even very soon for budget cars' high-speed charging will be a necessity.

A concern here is that these shifts in charging speeds create investment dilemmas for charge point operators who hold back on expanding the network at the risk of installing charge points that might soon be obsolete. As Respondent 66 noted:

> “All the car manufacturers are saying in two- or three years’ time 50-kilowatt DC [chargers] will be obsolete. We'll all be looking at 100-kilowatt to 200-kilowatt […] If you bought a Nissan LEAF in 2011 or 2012, and you had 100 kilometres or 120 kilometres on a charge, well, of course, you're going to want to charge around every corner and up every alley […] But if you buy a new ID3 […] you are going to have more than 400 kilometres on a charge […] So, people are making decisions, and they're thinking based on old technology in a fast-moving, evolving and dynamic industry [...] we don't want to own chargers and have to deal with all of the operations and the customer and buy something that's going to be obsolete in two years’ time.” (Respondent 66, local authority representative)

The investment dilemma around high-speed charging reflects how the economic agents driving the EV transition try to balance (and sometimes sacrifice) sustainability with/for economic objectives. Moreover, efforts to install fast charging, with a view to reduce charging times, interact with the electricity grid in ways that can yield negative consequences for society-nature relations. Respondent 49’s response gave a sense of the less noticeable socio-natural transformations that need to occur to install highspeed charging infrastructure:

> “EV charging at a high level doesn't seem that complicated but once you actually get into installing in certain environments, there's a lot to take into account […] everyone wants fast chargers, DC chargers. It's just not feasible […] if you want a 300-kilowatt rapid charger, it's the same process with the grid as putting up a wind turbine potentially. That's the amount of power, you have to think of the earthing, you have to think about substations, you have to think fault levels down here going back to the main substations…” (Respondent 49, charge point operations representative)

The type of transformations needed to install high-speed charging infrastructure has implications for how the electricity grid is locally configured. At the same time, reconfiguring the grid is a capital-intensive process with implications for the return on investment sought by economic agents. A point that I revisit in Chapter 5 below. Consider Respondent 45's comments:

> "…[the charging hub] located at Monasterevin is six 150 kilowatt [chargers], two 50 kilowatt [chargers], and I think two 22 kilowatt AC [charge points] […] So, you need to have a megawatt of capacity in the local network to deliver power to that hub […] they had a new point of connection put in, a new substation, a new transformer. So that means that they had to upgrade the supply on the site. Now a transformer at that site plus the work to put it in on their own scheduled rates is about €30,000 […] The house that the transformer goes in could be another €30,000. The trenching to run the cables out runs at about €200 a meter, and that all assumes that there's power in the supply circuit. So, if the circuit coming to the site doesn't have a megawatt available or one MVA available, then it needs to get upgraded as well, and that can mean upgrading a switching station, or it can mean upgrading lines or upgrading both […] So although your charger hardware might be €60,000 per rapid charger, so ostensibly three rows of rapids are €180,000 […] The labour, cabling, and hardware might be less than €300,000. You might have another €400,000 in grid reinforcement." (Respondent 46, charge point operations representative)

In terms of the ecological impact of reconfiguring the grid, one key dilemma relates to the local availability of renewable energy on the grid. For example, Respondent 41 recounted his experience working with a large corporation that discontinued a project due to concerns about the local availability of power:

> “…the first time that I had any idea that there was a problem with the grid was when I went to a large corporate company [to discuss moving their company fleet to EVs] […] Their engineering department was asked to come to the meeting [and they] point blank shoot down the idea of charging infrastructure […] They didn't really understand how much power would be coming from the main power of the building […] I said, ‘Oh, are you trying to explain to me that you have to be careful about the power because you don't really have any headroom, […] well, why don't you get more power?’ And they all just laughed [and said] ‘it probably would mean developing a whole new substation and set of transformers, which would take time, which would take a plot of land, which would take planning permission, which would also affect the total power demand in this area, which is already sky high […] we'd actually be increasing the amount of oil and gas that's burnt in this generation system down here [….] So, we'd be better off scaling back our EV ambition’...” (Respondent 42, automotive sector representative)

What we can see here is one way in which the turn to EVs contributes to the growing gap between renewable energy and power demand, which prolongs the use of fossil fuels in electricity production, on the one hand, and prompts economic agents to slow down commitments to the wider EV project, on the other. The result is a lack of clear vision of how the EV project should look.

In summary, the incoherent imaginaries of EV drivers bring to light some of the society-nature relationships that underpin the shift towards EVs. I argue that an approach akin to critical urban transition studies can account for this level of incoherence through the lens of UPE. As Swyngedouw and Heynen (2003, p. 906) suggest, UPE can direct attention to “…interwoven knots of social process, material metabolism, and spatial form that go into the formation of contemporary urban socio-natural landscapes.” The CUTS framework I develop draws upon UPE to explain how actors shaping these landscapes enrol socio-natural processes in ways that make them explicit *and* obscure. What emerges are sets of contradictions, conflicts and tensions around the political-ecological imaginaries underlying the turn to EVs. The benefits of adopting, using, and expanding EVs are well-signposted by actors, helping to move our understanding of the ecologies of the decarbonising city beyond a focus on CO2 reductions, albeit in localized and pristine ways. Yet, obscured in the imaginaries advanced by actors are more destructive elements of the transition that reproduce the uneven development of global capitalism and undermine the decarbonizing process itself. What I find is that this incoherence is a key part of the context in which the EV pilot project emerged: the inadequate infrastructure I charted above is partly explained via efforts to reproduce Dublin's unique system of automobility. The incoherent imaginaries outlined here explain why we find limited interventions, weak ideas, poor strategies, endless pilots, and a lack of appetite for a clear pathway. If the MLP foregrounds the struggles around niche innovations, CUTS needs to draw on UPE to examine the nature-society relationships that underlie those struggles. However, there is still a pressing need to examine how public and private actors are all caught up in the action. As such, I now turn to Marxian approaches to urban development to examine the inconstant and insufficient interventions that shape the EV pilot project.

4.5 Conclusion

The shift towards EVs in Dublin today has emerged from a history of urban experimentation aimed at creating the conditions for decarbonization. A nascent technological regime with far-reaching consequences for and beyond the city is emerging. This chapter traced the initial efforts to provoke the turn to EVs in Dublin and examined elements of its trajectory since. Drawing on the scholarship engaging the multi-level perspective (MLP) and urban political ecology (UPE), I argued that Dublin's EV project, to date, has produced an *inadequate infrastructure* that constrains the objective of decarbonizing the city and is underpinned by *incoherent imaginaries* regarding the so-called environmental reason for adopting, using, and expanding EVs. A crucial point here is that the MLP suggests the need to expect configuration failures due to the "teething problems" (Geels, et al., 2008, p. 522) associated with niche innovations such as charge points. My analysis demonstrated the need to *also* understand these failures in the context of their geography to the extent that locations and sites hosting charge points were determining factors underlying the inadequate infrastructure. Yet, my analysis also sheds light on the ways in which efforts to move beyond experimentation produced a type of restructuring project in Dublin that prioritizes individualised and hypermobile transportation over the deeper ecological transformations needed to decarbonize. While this project does alter "the regulation of our relationships with nature in cities" (Keil, 2003, p. 729) inasmuch as EVs have environmental benefits for the city (e.g., reduced noise and air pollution), these benefits come at a cost to, and I argue obscure, those communities living the sacrifice zones, which provide the critical raw materials and resources to prop the EV sector and produces new capital- and resource-intensive transportation models, which I examine in closer detail in next chapter.

To conclude, I argue that by drawing on the MLP and UPE, CUTS can bring to the surface the contradiction, conflicts, and tensions underlying the turn to EVs, in which efforts to expand and shape the so-called sustainable innovation of the EV project to reflect 'the system of automobility' (Urry, 2004) that has dominated transportation systems for close to a century now, in turn, producing destructive and uneven transformations. CUTS can make visible the less noticeable connections between niche innovations and the society-nature relationships underpinning them. Yet, the pathways of Dublin's EV project also signpost a wider terrain of political-economic action that demands attention; it calls attention to the state-capital interplay that shapes the decarbonizing project at a variety of scales. Moves by ESB ecars and CRU to steer the transition intimately relate to the niche-action and environmental dynamics of the EV project, but they develop in a context where actors driving the transition seek to balance economic and environmental tensions. In this regard, I argue that CUTS must look to Marxian approaches to urban development to examine the political-economic dimensions of the transition. I now turn to examine the third core finding of my research: the inconstant and insufficient interventions by the public and private sectors.

Chapter 5: Critical Urban Transition Studies in Question (II)

5.1 Introduction

In the previous chapter, I drew upon the multi-level perspective (MLP) and urban political ecology (UPE) to examine two core findings in relation to the 'inadequate infrastructures' that constrain the objective of decarbonising the city and the 'incoherent imaginaries' regarding the so-called environmental reason for adopting, using, and expanding EVs. I focused on the benefits and limits of the MLP for examining Dublin's EV transition and highlighted how actors make explicit and obscure the ecological transformations therein.

In this chapter, I draw from Marxian approaches to urban development to examine the third core finding: 'the inconstant and insufficient interventions' by the public and private sectors. Since the completion of the EV pilot project in 2018, there has been a wider terrain of public and private sector interventions made by organisations such as ESB ecars and Nissan across a variety of scales. The EV project had yet to deliver on the promises of 'green growth' made by the Irish government, but its dynamics had shifted towards a more market-oriented approach aimed at creating the conditions for accumulation within Dublin's EV market. However, the following chapter demonstrates how these efforts have been ineffective due to the inconstant and insufficient characteristics of the interventions pursued by the private sector. I examine how the public and private sector interventions charted in the previous section 'come to ground' in Dublin to produce inadequate infrastructure.

I organise the following materials as follows. In Section 6.2, I zoom in on the public sector interventions shaping the turn to EVs in Dublin. I then use Section 6.3 to focus on the private sector interventions shaping the turn to EVs in Dublin, which I then shed further light on via a case study in Section 6.4 of one CPO firm. In Section 6.5, I discuss the analysis in the context of 'actually existing neoliberalism' in Dublin. Finally, Section 6.6 brings the chapter to a close.

5.2 Characterizing public sector interventions in Dublin's EV project

There is evidence that the public sector made interventions aimed at steering the pathways towards EVs in Dublin. The respondents highlighted a range of strategies, projects, and practices pursued by the state across a variety of scales, which aimed to encourage infrastructural development and increase EV sales. The evidence suggests, however, that these efforts were largely inadequate. I identify two core interventions and consider how they produced an inconstant and insufficient approach to Dublin's turn to EVs.

The first public sector intervention I examine relates to efforts to support ESB ecars, which is a semi-state organisation whose operations to date have hinged on public support. I begin by explaining the developments that took shape following the closing down of the EV pilot project, which I have discussed above in Section 5.2. As previously examined, the EV Pilot Project closed in 2018, and in the months leading up to its completion, there was evidence that ESB ecars had neglected to expand and maintain the charging network to an appropriate level. This neglect stemmed, in large part, from the uncertainties arising over who should have ownership of the assets associated with the pilot project. The CRU ultimately resolved the issue in 2018 by authorizing ESB ecars to take ownership of the assets with the stipulation that the charging network be sold or operated on a commercial basis. As the CRU states in its decision paper regarding the pilot project:

> "…the CRU remains of its position that […] the assets should either be sold or maintained by ESBN on a commercial basis […] Therefore any further funding required would have to come from other sources such as, for example, subsidies or from fees recovered from the users of EVs […] The CRU expects ESBN to arrange the sale of the assets to maximise the value that can be recovered from the Research and Development (R&D) expenditure made by the DUoS customer on the EV infrastructure during the trial […] until the sale is ready, ESBN will ensure that the assets are adequately operated and maintained." (CRU, 2017, p. 1)

Commercialisation, then, brought with it significant changes to Dublin's EV charging landscape. Among the changes, ESB ecars introduced a pay-as-you-go tariff and a membership[1] tariff for fast chargers (23-50 kWh) for the first time in November 2019 (O'Brien, 2019). In the years that followed, ESB ecars restructured their tariffs on four occasions. First, by introducing fees for standard charging (up to 22 kWh) in August 2020 (Cunningham, 2020). Followed by the establishment of high-powered charging (51-150 kWh) in July 2021 (Lee, 2021). The final two alterations to the pricing structure related to general price increases implemented by ESB ecars across all charging speeds in their network in May and December of 2022 (ESB ecars, 2022; Gorman, 2022). Tables 6.1 and 6.2 provide a chart out the changes:

Table 5.1 ESB ecars pay-you-go price structure.

Date	**Fast Charging (23kW-50kW, €/kWh)**	**High Power Charging (51-150kW, €/kWh)**	**Standard charging (up to 22 €/kWh)**
18/11/2019	€0.33	Not yet introduced	Not yet introduced
04/09/2020	€0.33	Not yet introduced	€0.268
10/09/2020	€0.33	Not yet introduced	€0.268
05/07/2021	€0.33	€0.37	€0.268
05/05/2022	€0.45	€0.48	€0.39
20/12/2022	€0.647	€0.682	€0.563

Table 5.2 ESB ecars membership price structure.

Date	**Fast Charging (23kW-50kW, €/kWh)**	**High Power Charging (51-150kW, €/kWh)**	**Standard charging (up to 22 €/kWh)**
18/11/2019	€0.27	Not yet introduced	Not yet introduced
04/09/2020	€0.27	Not yet introduced	€0.23
10/09/2020	€0.27	Not yet introduced	€0.23

[1] ESB ecars membership began €4.60 a month and is now €4.99.

05/07/2021	€0.27	€0.37	€0.23
05/05/2022	€0.41	€0.44	€0.35
20/12/2022	€0.586	€0.617	€0.509

The price restructuring encouraged competition within the charge point operation sector. A point I revisit in section 6.4 What I dwell on now is another outcome, which is related to ESB ecars' efforts to pursue an 'upgrade programme' across its charging network. According to an interview with ESB's executive director of customer solutions, Marguerite Sayers, the network could only be improved via commercialisation:

> "From our point of view, the only way that we are going to improve the network, that we can keep the standard up, that we can replace the technologies is actually by making it more commercial (Hilliard, 2018)."

In this regard, ESB aimed to leverage commercialisation to deliver "…the replacement of 264 legacy Standard (AC) chargers […] The upgrade of 52 locations to provide Fast (DC) charging at that location [and] developing 56 [high powered charging] hubs throughout Ireland… (Sayers & Byrne, 2021, p. 2)." The upgrades were not commercially funded in their entirety. ESB ecars received €20 million in public funding to support the upgrades, with €10 million provided by the Climate Action Fund and €10 million coming from the ESB group (Sayers & Byrne, 2021, p. 2). I argue that it is worth examining these 'upgrades' for the sake of probing the effectiveness of ESB's commercialisation strategy as well as the public sector actions underpinning it.

Among the EV users who engaged with this aspect of the research, there was a tendency for them to agree with Marguerite Sayers' assessment. Respondent 1, for example, noted how members of the Irish Electric Vehicle Owners' Association (IEVOA) showed broad-based support for the introduction of tariffs:

> "When we moved from free to paying for charging, actually about 80 per cent of users wanted to pay. It is something that may sound strange, but after a while, you know you're getting what you paid for, and people realise if it's free, you get a shitty service, but if we pay for it, it gets better…" (Respondent 1, EV user)

This reference to '…if it's free, you get a shitty service…' reflects how the free-of-charge approach associated with the EV pilot project left a mark in the minds of EV users. Seen in this light, a publicly owned and free service was likely to fail. This support of a more market-oriented approach was not the only time that EV users, at large, showed a desire to ally themselves with capital. I aim to revisit this point in Chapter 6.

For now, I argue that it is worth noting that the needs of some users, particularly those who drove older EV models, were overlooked by ESB ecars in their efforts to upgrade the network vis á vis commercialise. As Respondent 26 highlighted:

> "…all I know is there was a huge change [emerging from commercialisation], and now [ESB ecars are] installing fast chargers that they can get more money out of […] it is funny how slow chargers that were popular, now suddenly are fast chargers […] I mean, there is one that is on my journey that I do regularly that I am dreading the day they replace it […] my [Renault] Zoe that I drive all the time, it can only charge [at] 22 kilowatts. I do not need a 50-kilowatt charger. I need a 22-kilowatt charger. If they connect it to a fast charger, they can charge for more money." (Respondent 26, EV user)

Per Respondent 26, there is evidence that the upgrades pursued by ESB ecars produced a level of fragmentation for EV users. This fragmentation has implications for the charging capabilities of a significant proportion of the existing fleet.[2] Going forward, a key consideration concerns how access to the charging infrastructure may become fractured along socio-economic lines. Not only does high-speed charging cost more, but the buyers of second-hand and used cars, those EV users who can only afford older models from the existing fleet, may have limited access to the public chargers they require.

Yet, for respondents, the shortcomings of ESB ecars' upgrade programme developed not so much out of concerns over access, although that is certainly a key element, but from a wider sense that ESB ecars were *still* not moving quickly enough. Two years after ESB ecars had submitted the written statement to the Joint Committee on Environment and Climate to garner support for their upgrade programme, Professor Barry McMullin of Dublin College University noted in an interview that:

> "The public charging infrastructure, particularly for longer journeys, *continues* to be unsatisfactory. It's not widely enough deployed and where it is deployed there aren't enough units. So, we hear horror stories of people arriving at charging stations and there might be two chargers, but one is broken and there's a queue of three cars for the other one (O'Donoghue, 2023: my emphasis)."

In other words, the promise that commercialisation could, and would, deliver an improved infrastructure had not materialised. A reason that goes a long way to explain this shortcoming related to the so-called business case that ESB ecars faced in their efforts to roll out EV charging infrastructure. For example, Respondent 71, who had worked with ESB ecars, argued that the scale of demand was not large enough in Ireland compared to some of its European counterparts:

[2] Approximately 450 first-generation Renault Zoe models were sold in Ireland (SIMI, 2023), which cannot effectively draw from the DC chargers targeted by ESB ecars' upgrades. In addition, if subsidizing new EVs initially developed out of a strategy aimed at boosting second and used car markets, negating the charging requirements of older EVs undermines this position.

> "So, [ESB ecars are] in the middle, as I said, of a 20-million-euro investment demand. Ten of that is coming from the Climate Action Fund… [the problem is] investing ahead of the demand in EVs has always been very challenging […] it's very capital intensive, there's huge planning costs, the cost for a grid connection and the equipment is very, very expensive […] the business case is very challenging […] it is not at all profitable yet […] [London is] a totally different area. [ESB ecars] have chargers over there that are in use on average 16 hours of the 24 every day, and the reason for that is just the sheer number of vehicles on the roads." (Respondent 71, semi-state representative)

There is evidence, then, that ESB ecars, despite their semi-state status and the use of public funds, are beholden to 'growth first' strategies. Their investments are timed, not around a decarbonisation agenda, but around efforts to ensure the future realisation of profit.

At the same time, other respondents argued that the reason ESB struggled to deliver the necessary interventions was that they were burdened by the governance structures of the public sector but still expected to act in a market-oriented fashion. As Respondent 46 argued:

> "…the ESB has never had to move fast […] They've always been working on project timelines of a couple of years and that's been fine because they've been able to have a good idea of what's coming so they can plan their routes, acquire the land, get the cabling, lay the polls […] that sort of thing involving slow, steady paced work, they've never had to react. Now they do […] Scratch beneath the surface, you will find that most of the people […] are waiting on decision-makers in other sectors, who are waiting on legislators to say they can do things, or it can be like what you see in the SEAI all the time, where they are

> just petrified of getting audited, and they take no risks. If they can pass the buck, they won't do it.” (Respondent 46, charge point operations)

What we can see here is how the paradox of the semi-state produces insufficient and inconstant interventions. ESB ecars are expected to be growth-oriented, even entrepreneurial, but must balance those expectations with the governance, risk management, and compliance factors that characterise public sector organisations.

On top of these factors, there is a final issue I wish to focus on that complicates ESB ecars’ role within Dublin’s EV infrastructural provision. This issue concerns the EU energy liberalisation directive known as the European Directive 2019/944 on the common rules for the internal market for electricity. Article 33 of the directive states:

> “Distribution system operators shall not own, develop, manage or operate recharging points for electric vehicles, except where distribution system operators own private recharging points solely for their own use (The European Parliament and the Council of the European Union, 2019, p. 36).”

ESB ecars is a subsidiary of the ESB group, which is also the parent company of ESB networks, the distribution system operator in Ireland. However, Respondent 72 argued that the ESB group could circumvent the directive through its corporate structure:

> “So, the distribution system owner and operator are ESB networks, DAC: designated activity company. ESB ecars is a sub-company of ESB group […] [ESB ecars is] separate from ESB networks, because networks hold the license for the distribution system as a separate entity.” (Respondent 72, semi-state representative)

Nevertheless, this liberalisation directive has previously been cited by competing charge point providers, such as EasyGo, who have called for privatisation of Ireland's charging infrastructure in its entirety (see: Briscoe, 2021). Many respondents operating in the private sector expect ESB ecars to sell the network to a private entity. For Respondent 52, it was a matter of when, not if:

> "…everybody's waiting for the dust to settle […] What is the long-term aim of the ESB ecars and their car charging network? They'll most likely flog it onto somebody […] That's just the nature of a semi-state body, whose job is to build infrastructure for the common good out of our communal fund. That network is going to be sold. That's the intention. It's not a commercially run business…" (Respondent 52, energy sector representative)

There are tensions between ESB ecars' market-oriented practices and, per Respondent 52, their efforts '…to build infrastructure for the common good out of our communal fund.' Not only is ESB ecars' approach to EV infrastructure inconstant, but their position is markedly unstable. Dublin's EV transition and the wider decarbonising project suffer as a result. I now turn to the second intervention with a view to demonstrating another public sector arena in which these tensions around balancing sustainability and economic objectives emerge.

The second public sector intervention I consider relates to efforts to enrol Dublin's local authorities into infrastructural projects. In focus is a grant scheme known as the 'the Public Charge Point Scheme', which subsequently led to the development of 'The Dublin Local Authority Electric Vehicle Charging Strategy.' The scheme was announced in 2019 by then Minister for Communications, Climate Action and Environment Richard Bruton and was intended to support up to 200 charge points per annum for the following five years (Burns, 2023). The scheme was coordinated by the SEAI with support from the Department of Transport and sought to provide local governments with 75 per cent of the capital cost for the development of EV charging points in their administrative areas, with a maximum of €5,000 per charge point (Oireachtas, 2020). According to Respondent 65, who had worked in the department that had helped to devise the scheme, local authorities were targeted because of their administrative and legal role in planning and development in Ireland:

> "… our stakeholders are local authorities because they own the public roads […] There is state property that we can put [EV infrastructure] on […] So, we as a department might put it onto the local councils' visitor attractions, libraries, swimming pools, council lands […] that's where the state can intervene…" (Respondent 65, local authority representative)

Per Respondent 65, there was a high degree of pragmatism guiding the decision to target local authorities. Local authorities have been responsible for Irish roads since the Local Government Act of 1925 (see Part III of act: Oireachtas, 1925). Moreover, development and planning are mandatory functions of local authorities in Ireland (see: Fox-Rogers & Murphy, 2014).[3] The scheme, then, was devised with these roles and responsibilities in mind. However, from 2019 until 2023, it only delivered 38 out of the 1,000 charge points promised (Burns, 2023).[4] In this regard, I ask: exactly why did local authorities opt not to use the scheme? When according to the Minister for Transport, Eamon Ryan, "If a local authority really wanted to [develop charge points], it could have done so (Oireachtas, 2023)."

For Respondent 67, the primary reason for the low uptake was that the Public Charge Point Scheme did not…

> "…cover the costs to provide the infrastructure […] There's a lot of construction work to be done to actually get the power […] [A standard

[3] Local governments are required to produce development plans, including local area plans, every six years and are also responsible for authorising building and infrastructural development via the planning permission process.
[4] Not all these charge points were installed in the Dublin region: Dublin City Council (9), Louth County Council (20), Tipperary County Council (6) and Meath County Council (3).

> charge point] cost the councils, somewhere in the region of €12,000 to €13,000, and the grant from the SEAI was €5,000 […] Local authorities are never going to go and go down the route of fully funding chargers because it's not their market. Ultimately, they're not a power supplier, they're not a fuel supplier…" (Respondent 67, local authority representative)

Per Respondent 67, the scheme's funding was insufficient. Considering Fox-Rogers and Murphy's comment (2014, p. 252) that "limited opportunities exist for [local] authorities to raise income independently of central government [in Ireland]", without the appropriate capital backing, the scheme was always likely to fail.

This lack of support, moreover, was not only related to the upfront costs of purchasing and installing the charge points. It was also concerned with the operational costs. For example, Respondent 66, who had worked with the councils during the scheme, argued that without a dedicated team on hand to provide all the maintenance and repair and backend support, his only option was to look to outsource the role of developing EV infrastructure:

> "So, if I'm to go start sticking chargers […] people will be screaming, 'these things aren't fast enough, I have to charge it the whole day, and you're not fixing it, etcetera, etcetera.' Why am I not? Because I don't have the resources, because the Department [of Transport] will only give me a capital budget, they won't give me an operational budget to hire a team to actually do that, which is why I need to outsource it, which is why I need a model that actually works for the private sector." (Respondent 66, local authority representative)

A crucial point here is that the resource limits highlighted by Respondent 66 were not an emergent feature of public sector work. Rather, they reflected a longer legacy of budget cuts that can be traced back to the global financial crises that had not yet been resolved. Consider Respondent 65:

> “I joined the Civil Service here in 2009 at the launch of the National Sustainable Travel Policy, Smarter Travel […] the next year the country was bankrupt. So, we lost a decade in terms of our investment […] our [EV] policy is probably the same as it was in 2010 but we're 10 years closer to the deadline […] It wasn't just about funding. But one of the things that happened in the recession was that the numbers in public sector departments just reduced dramatically. Loads of people retired, and as people retired, they weren't replaced […] we had divisions […] suddenly three divisions became one […] what happens then is you do all of the urgent stuff […] all of the stuff about building for the future stops.” (Respondent 65, central state representative)

Another key issue relates to a general culture of risk aversion that pervades the public sector in Ireland. For Respondent 66, his actions were not only scrutinized by his own organization but from the private sector too:

> “…see when you're a local authority, or in the public sector, generally, governance is a big thing. It's one of the key pillars that we all have to abide by. So, when I get into something like this, I'm quite happy run pilot projects and that gives me learnings. But when you go out to do bigger scale things. If you don't do a properly, you fall foul of the market and the market will say, ‘well why haven't you gone out to public procurement for this? Why haven't you given everybody an opportunity to have a go at this?’ […] I'd love to go and say or do X, Y and Z but I won't follow the rules and the regulations. But as soon as I do that sure I'll have the market and auditors and all different things coming to me.” (Respondent 66, local authority representative).

The upshot is a sense of inertia, an inability to move beyond the pilot experiment that has defined public sector intervention in Dublin's EV project to date. Instead of opting into the scheme and being burdened with associated resource demands, the local authorities took a different approach. What emerged was the Dublin Local Authority Electric Vehicle Charging Strategy (see: Element Energy, 2022). The strategy was published in June 2022, three years after the Public Charge Point Scheme began. It was written by UK-based energy consultancy firm Element Energy and commissioned by Dublin's four local authorities, alongside the Dublin Metropolitan Climate Action Regional Office (CARO) and Smart Dublin.[5]

The strategy's primary aim was to assess the EV infrastructural requirements of Dublin County using two EV uptake scenarios. The first scenario was based on the 2030 Climate Action Plan targets. The second was a 'medium scenario', which the strategy argued was "judged to be a more realistic trajectory" (Element Energy, 2022, p. 4) and based on "…the sales growth seen in some world-leading countries (Norway, Sweden, Iceland)" (p. 45). The strategy noted that it did "…not envisage that the [local authorities] would be responsible for any significant installation, operation or maintenance of [EV charge points] (p. 6)." Instead, the strategy sought to put measures in place to outsource the development of EV charging infrastructure to the private sector. In sum, the private sector would be provided with the necessary public land but would pay rents to Dublin's local authorities. According to Respondent 67, the strategy was, in reality, a market exercise:

> "…our strategy is that we're telling the market what […] we think is going to be needed to provide the infrastructure […] it's explaining the plan to them, but it's also kind of getting the market ready for when we actually go to do something. So, they know this is coming down the line. It's setting the scene for them […] this plan is very, very

[5] A noteworthy aspect of the strategy is that the collaboration by the organisation involved resembled a type of metropolitan structure that historically has not featured much in Irish politics. As Moore-Cherry and Tomaney (2018, p. 365) argue, there has been "…a central state stranglehold over the Dublin metropolitan area…".

> comprehensive […] we have key locations where we think that the chargers will be required…" (Respondent 67, local authority representative)

Beyond priming the market, the strategy *also* sought to shift the focus in Dublin from slow-speed standard charging to rapid hub charging, which was identified as "…the optimal residential charging solution…" (p.21). Rapid hub charging was judged to be more investment-friendly for firms due to the higher costs of charging and because the turnover rate of EV users at the chargers was assumed to be quicker.

Building hubs, however, is a capital-intensive process, as I have previously discussed in Section 5.3 above. Consequently, respondents argued that to entice investment from the private sector, the charging hubs would need to be publicly subsidized. As Respondent 66 pointed out:

> "…the only option open to us is to go out to the market and give it over to the private sector in a way that they can actually make a few bob out of it. Now, international experience says they need to be subsidized in the initial phase. So, if we're going to 2030, maybe 2025, it might be like 75% subsidy […] there's a few different models out there that have potential that might generate a sufficient return for the charge point operator for them to actually engage in the space." (Respondent 66, local authority representative)

The glaring contradiction here is that the public purse will subsidize private investment for an infrastructure that was deemed by local authorities to be excessively capital- and labour-intensive. The strategy aimed to shift away from the role the Public Charge Point Scheme had envisaged that the local authorities would play. There are contested dynamics here of what Smith (2002, p. 429) refers to as "…the mobilization not just of state power but of state power organized and exercised at different geographical scales." The Irish central state sought to devolve efforts to develop the infrastructure to the local authorities. In turn, the local authorities were compelled to commit to a more market-oriented project.

5.3 Characterizing private sector interventions in Dublin's EV project

In this subsection, I examine private sector interventions. I focus on how investments made by automobile firms on a global scale produce inconstant and insufficient interventions within Dublin's EV sector. I explore how the global shift towards electromobility seeks to balance economic and sustainability objectives in ways that pressure local economic agents to produce the place-specific pathways needed to decarbonise. I divide the following discussion in to two parts.

I first consider the actions of automobile firms operating on a global scale. The shift to EVs has been a heavily contested and chaotic global project marked by inter- and infra-firm battles. I consider this contestation through the cases of Volkswagen, Toyota, and Nissan. According to Fortune 500 (Confino, 2022), Volkswagen was the largest automaker in the world in 2022, with a revenue of €295.8 billion. In 2021, the year in which my fieldwork took place, the Volkswagen group – which includes Volkswagen, Audi, Porsche, Skoda, and SEAT – sold between 8.6 and 9.2 million vehicles worldwide, of which 762,400 were EVs (see: Volkswagen Group, 2021a; Kane, 2021). For many respondents, the emergence of Volkswagen's EVs, specifically the ID model, signalled a turning point in EV technologies because of the larger battery sizes and long ranges of the ID.3 and ID.4. Consider Respondent 57:

> "…you look at Volkswagen, the ID.3, and the ID.4, they are only really taken off this year. [They are] a mainstream, acceptable car, not an EV, but a car [because] having battery ranges sitting between 40- to 70-kilowatt hours, that's the sweet spot […] That's what the manufacturers are supplying now, and that's giving people the comfort level to move over to EVs." (Respondent 57, charge point operations representative)

Per Respondent 57, the ID models were one of the first EVs to demonstrate what a mass-produced EV could and should look like. In 2021, Volkswagen's ID range would go on to become the most-sold EV type in Ireland (SIMI, 2023). I argue it is worth tracing the history of Volkswagen's ID range to probe how it became Europe's most successful EV. According to Respondent 42, Volkswagen's success in the EV market must be traced back to the 2015 diesel emissions scandal, otherwise referred to as Dieselgate:

> "…Volkswagen's executives were facing real jail time in court in the United States; we had a massive turn against Volkswagen across all of the European countries; we had a realisation by the public that the CO2 figures and the air pollution figures may all be lies; we had a non-existent European EV industry other than Renault and Nissan, and that meant that the normal market forces that would bring any model of cars forward weren't going to happen. So, the bizarre silver lining in the cloud of Dieselgate is that in order to avoid being jailed […], Volkswagen finds themselves having to develop EVs […] Volkswagen has only just launched the ID.3 and the ID.4 in the last month really [May 2021], but they bring to the market an everyday user understanding of the motor car." (Respondent 42, automotive sector representative)

From 2009 until 2015, Volkswagen tampered with approximately 11 million cars by installing illegal software into diesel engines to circumvent emissions testing (Gardiner, 2019).[6] Facing pressures from regulators in the aftermath of Dieselgate, Volkswagen accelerated the launch of a series of different EV models across its subsidiary companies in what many respondents understood to be the first major shift in the EV market.

[6] Under closer investigation, tampering with diesel engines to cheat emissions testing was an industry-wide practice. For example, of the 53 models sold in Germany, all but three exceeded the emissions limit. In addition, the testing firm Emissions Analytics (see: Carrington, 2016) found that 97 per cent of over 250 were in violation. 43 million cars, in total, were affected, of which 13 million are still on the road in Europe today.

Understanding how Volkswagen's emergence in the EV market came to the fore can help us to probe the interventions the firm has made since. For many respondents, the relative success of Volkswagen's initial moves in the EV market was overshadowed by the inconstant nature of the firm's actions. For example, the firm lobbied for the provision of e-fuels[7] within EU climate policies and, in 2023, the EU Commission altered regulations that would ban new combustion engine sales after 2035 to allow for the provision of e-fuels in a move that has been described by Greenpeace's mobility expert, Benjamin Stephana, as a "…rotten compromise that undermines climate protection in transport (Deutsche Welle, 2023)." This dispensation came off the back of lobbying efforts led by Germany's VDA car lobby alongside the German Transport Minister Volker Wissing, who argued that "to ban [e-fuels] now makes no sense because [they] create more and more competition and better prices for citizens (Alkousaa & Wacket, 2023)." For Volkswagen's CEO, Oliver Blume, the addition of e-fuels within the regulations appeared to be a success story of what he had previously described as the best decarbonisation pathway: "…a double-path: e-mobility and e-fuels (Uhlenbroich, 2022)."

Another intervention relates to Volkswagen's announcement that while the firm intended to cease production of petrol and diesel engines by 2035, it was committed to propping up the sales of internal combustion engines because "… a robust-margin ICE business, generating strong cash-flows will finance and accelerate the shift to BEVs (Volkswagen Group, 2021b)." In other words, the firm has no intention of winding down internal combustion sales until it is required to by regulation. According to Respondent 43, this strategy filtered down to dealerships at the local scale and impacted their willingness to sell EVs:

[7] E-fuels are produced using electricity generated from renewable sources, which separate hydrogen from water and then combine the hydrogen with carbon dioxide that has been removed from the atmosphere and stored. When the fuel is burnt, CO2 is *still* emitted from the tailpipe but is said to be offset by the removal of the carbon dioxide from the atmosphere that helped to produce the fuel.

> "Europe has gotten behind EVs because of Dieselgate, you know, the Volkswagen Group messed up […] It's interesting because they are still a legacy automaker. Their history and tradition are in ICEs, and even the other day, the head of sales at Volkswagen [said], […] 'maintaining high cash flows from ICE business to finance the transition will be paramount' […] An organization like Volkswagen, which is making billions in profit a year [needs to] stop saying things like ICEs will fund this [EV transition] […] I think it definitely ties into […] the dealerships […] My wife […] went to the dealership last year, and pretty much what we heard was like, 'ah sure, you don't want that [EV], you want this [ICE] over here'." (Respondent 44, journalist)

Volkswagen appears to have no intention of winding down internal combustion engine sales. The petrol and diesel engines sold will likely remain in used- and second-hand car markets well beyond 2035. I argue that interventions aimed at circumventing regulation is indicative of the inconstant interventions underlying the global decarbonising project. The upshot is an inconsistent vision of what the pathways to decarbonise will look like. I revisit Respondent 43's point on dealership later in this section.

Volkswagen has not been the only automobile manufacturer whose approach to the EV transition can be characterised as inconstant. I now turn to the inter-firm dynamics of Toyota and Nissan. A crucial point here is that EU policy has been less effective in guiding the strategic direction of Japanese automobile firms because their holding companies, franchises or manufacturers operate within a different geopolitical context with a different set of decarbonising directives. For example, in 2022, EVs only accounted for around 1 per cent of all new car sales in Japan, in contrast with the more popular hybrid vehicles, which accounted for about 40% of new passenger car sales in Japan (Nagata, 2022). According to Respondent 46, one reason that goes a long way to explain why hybrid engines have been more popular relates to the role of automobile manufacturing in the Japanese economy:

> “Toyota recently came out and basically said that the reason they weren't going electric was because engine manufacturing supports too many jobs in Japan. That's it. No interest in trying to do something to redirect their entire industrial sector. Just that, you know, we have jobs, if we stopped producing engines, we wouldn’t have jobs […] They're effectively saying we're just going to roll over in a ditch and die. It's utterly, utterly nuts, and I can't understand it.” (Respondent 46, charge point operations representative)

I argue that the Japanese context must be understood as central to Dublin’s transition to EVs because, on the one hand, Japanese manufacturers produce right-hand drives, which increases Ireland’s viability as an export market. On the other hand, as Brian Cooke, the director of the SIMI, suggested in one report, Japanese imports are likely to increase in Ireland’s post-Brexit trade landscape:

> “First, we've had Brexit, which has increased significantly the price of particularly older used imports […] If you look at the profile of the Japanese used imports, they tend to be 6 or 7-year-old petrol cars, though they don't have a double VAT charge like those older cars from the UK coming in […] So, we've seen about 3,500 Japanese used imports this year, compared to 4,500 for the full year last year, so you would expect to see maybe double that amount, maybe 9,000 or 10,000 Japanese used imports coming into Ireland (Egan, 2021).”

Evidence of Japan’s approach ‘coming to ground’ in Ireland can be seen with the success of Toyota’s ‘self-charging’ hybrid range in Ireland’s automobile market. Consider that Toyota sold more cars in Ireland than any other brand in 2022, with a figure of 16,051 sales. Around 96 per cent of the vehicles sold were self-charging hybrids (SIMI, 2023). The marketing behind self-charging hybrids has become symbolic of the greenwashing tactics pursued by automobile firms because the model uses petrol and diesel as their sole energy source but still leverages the marketing of EVs by claiming a ‘charging’ functionality. For Respondent 42, the success of self-charging hybrids in Ireland is indicative of the type of obfuscation developing around EVs:

> “…there is no such thing as a self-charging hybrid and the idea that the mechanisms within the state, and even places like Engineers Ireland, but definitely [the] ESB, in my mind, someone needed to go on TV and say, ‘there is no such thing as a self-charging hybrid’. Because what we did was, we allowed the self-charging hybrid to become the biggest selling car in Ireland, which is defeating our CO2 goals on an absolute scale […] that move towards hybrid elongated the presence of petrol engines within manufacturing, which by its very presence and income stream justifies the people who are standing there saying, ‘don't go yet, don't move towards more EVs. It's not the time.’ And it's very easy to justify that argument when you say, ‘look at the billions we're making out of these hybrids’...” (Respondent 42, automotive sector representative)

The term self-charging hybrid has been challenged by consumer authorities globally. For example, reports show how Norway’s Consumer Authority deemed Lexus’s self-charging hybrid claims to be misleading, whereas the US Advertising Standards Authority (ASA) rejected complaints made along the same lines (see: Jupp, 2020; Braithwaite-Smith, 2019). There is evidence that EV users in Dublin had sought to have the term banned by the Irish authorities. As Respondent 8 noted:

> “I was one of the EV community members that submitted to the Advertisement Standards Authority in relation to self-charging [hybrids]. I hate the fucking ads when I hear it on the radio. I hate it when I see people trying to advertise it.” (Respondent 8, EV user)

Toyota has organised its manufacturing and marketing around an accumulation strategy, which intends on capitalizing off the uncertainty surrounding EVs. When Nissan's interventions are brought to the surface, their approach to EVs demonstrates how firms are coerced to compete in ways that extend the presence of internal combustion engines in automobile markets. As mentioned in Section 5.2 above, Nissan Ireland, through its relationships with the state, has been instrumental in establishing Ireland's EV industry in Ireland. The Nissan LEAF was Ireland's top-selling EV from 2011 until 2020 (SIMI, 2023). To get to this position, according to Respondent 42, Nissan Ireland had much groundwork to cover:

> "I need to point this out to you that Nissan Ireland is not a subsidiary of Nissan Global […] [Nissan Ireland] is an Irish-owned company that happened to have an important distribution license and franchise for Nissan Vehicle in Ireland […] Nissan Ireland was the first company, and Ireland was the first country to roll EVs in Europe […] When [Nissan Ireland] brought in the first electric cars, there simply were no charging points. They hadn't been invented yet […] When you look back at the spending happening from 2010, a lot of that money came out of [Nissan Ireland's] own pockets. Try justifying a massive spend and doing things like leading the St Patrick's Day parade […], which is basically a €1 million […] That year [Nissan Ireland] sold 43 LEAFs." (Respondent 42, automotive sector representative)

Yet, as Respondent 42 *also* noted, Nissan Ireland's efforts to pioneer an EV industry were challenged by Nissan Global who sought to pressure its subsidiaries and franchisees to sell its hybrid models known as E-power:

> "So, E-power was a way of overcoming range anxiety and as a way of trying to reach happy medium […] [when E-power was announced] a fight ensues pretty much straight away between those that envisioned the company moving towards full-electric […] versus very

conservative Japanese management, who are worried […] You have giant revenues coming into Toyota, because of their hybrid dominance, and hybrid uptake at that time was 13 times EV […] You move to electric, and you discontinued the petrol engine, not only are you jeopardizing the supply chain of that petrol engine that's being used in Toyotas and Mitsubishis and Suzukis and Mazdas, you get the idea. But you're also potentially bringing about huge unemployment […] We then have the arrival of e-power as a solution to that problem from Nissan […] The Japanese approach to sustainability and climate change [is] at odds with the rest of Europe…" (Respondent 42, automotive sector representative)

What Respondent 42 indicates is how the Japanese political-economic context shapes the inter-firm dynamics of its automobile manufacturers. Firms are compelled, at least in part, to defend the circulation of capital flowing through Japan because of fixed investments in the country's manufacture or relatively long-lasting ties with the Japanese state. In addition, the success of one firm (i.e., Toyota) in boosting the circulation of capital around the production of one commodity coerces other firms (i.e., Nissan) to organise production along similar lines with a view to competing for a better share of sales. These dynamics undermine the possibility of having a consistent decarbonising plan because automobile firms are coerced to roll-out and roll-back on accumulation strategies to maximise profits. Respondent 27 demonstrates the ways these strategies 'come to ground':

"…my mum sent me a picture of her sister's new car and said, '[she's] after getting a new car, delighted with it, it's an electric car' […] I'm going 'oh that's lovely.' [It is a hybrid]. I'm not going to try and educate my mom or my auntie, as to, you're still burning fuel, you're still polluting the air' […] So, definitely the manufacturers and the distributors, and certain countries are using the lack of understanding in their marketing spin, whether that's a self-charging hybrid, whether

> that's e-power, whether that's eco-drive […] It'll all come out, in the end. They were trying to tell us that cigarettes were great […] I think that we will look back in 20 years' time and go, 'Oh, my God, how do they get away with that?' […] 'Did they have a conscience at all?'" (Respondent 27, EV user)

Per Respondent 27, firms not only produce inconstant characteristics but also seek to leverage them by capitalising on the confusion and uncertainty surrounding changes to the technicalities of automobiles:

Above, I have charted out the inconstant interventions that shape around the actions of automobile firms such as Volkswagen and Nissan operating at a global scale. I note there are also inconstant shifts in relation to the innovation surrounding EVs, particularly as firms compete over different charging standards and product specifications in what is often referred to as 'the charging wars' (see: Ewing, 2023). I return to this aspect of the turn to EVs later in Chapter 6 to analyse how EV users engage in Dublin's confusing charging scene. For now, I briefly turn to examine how the inconstant approaches touched on above gave rise to an insufficient infrastructure.

My second point examines how this overall dynamic develops in Dublin. A key point here is that the EV segment of Ireland's automobile market has shifted considerably since the EV pilot project. In 2010, there were only two EV models available to purchase; by 2016, there were six models; in 2022, there were at least 60 models available. The market *has* expanded, but the number of EVs and the infrastructure remain far behind the sufficient levels needed to produce meaningful decarbonisation. Despite the emergence of new EV-oriented firms such as Tesla[8] as well as the arrival of other so-called disruptors such as BYD auto[9],

[8] Tesla arrived in Dublin in April 2017. The firm has a relatively low corporate presence in the city, with around 20 employees but has consistently performed in the Irish market. For example, the Tesla Model 3 has been in the top five most-sold EVs in the Irish market since the firm arrived in 2017 (Deegan, 2023).

[9] BYD auto featured for the first time in Ireland's automobile market in 2023, carving out around 1% of all sales in the first half of the year (SIMI, 2023).

policymakers such as Respondent 65 have argued that there is a real concern that the automobile sector in Ireland will undermine the government's EV target by continuing to push the sale of internal combustion engines:

> "…this is the thing, like the vehicle manufacturers want to come on board with electric vehicles, but at the same time, they're still making ICEs, and they're planning on making ICEs. And so, they don't want Irish consumers to completely jump to EVs too quickly […] The risk is that the private sector maybe wants to keep selling its ICE. So, it's up to the consumer to kind of push for these more […] I guess the uncertainty we have is how that share between ICE and EVs will grow over the decade…" (Respondent 65, local authority representative)

There is evidence to suggest that automobile dealerships operating in Dublin have continued to push for the sale of petrol and diesel engines. Among the EV users who engaged with this component of my research, several noted experiences in local dealerships where salesmen nudged them towards purchasing an internal combustion engine. Consider Respondent 10's experience:

> "…we did call into a dealership and went exclusively with the notion of getting prices on a particular electric car, and we were told that, 'because we lived in a terrace house, we couldn't buy one', which was a very negative attitude I felt on the part of the salesman […] He said that to us within the first two minutes of meeting with him. I was like, what's the point in talking to him, and he then was trying to steer us towards other cars […] which is not good at all, when you subscribe to a philosophy, and you're matched with somebody who says, 'well, that's not really going to work for you'. And he also didn't know enough information about the car […] I quizzed him about the range of the car, and he almost halved the range […] then [the salesman] kind of went, 'maybe you should be looking at something more

> appropriate like this, which would be like an ICE car?' […] Which was, yeah, not great." (Respondent 10, EV user)

The experience of EV users, such as Respondent 10, reflected resistance within the Irish automobile market to embrace the EV transition. For example, during the year of my interviews, a lobbying organisation known as the Irish Car Carbon Reduction Alliance (ICCRA) had been lobbying the Irish government to postpone the 2030 EV target set out in the Climate Action Plan. The campaign, called E-way 2040, argued that the Irish automobile market was in no position to supply the number of EVs set out in the decarbonising strategy. Respondent 34, who had worked with an automobile firm at the corporate level in Dublin and was broadly supportive of ICCRA:

> "[The Irish automobile market] sells somewhere between 100,000 and 120,000 [vehicles] a year […] So, if we need to get a million EVs on the road in nine years-time, we need to sell over 100,000 EVs, each year, every year, for the next nine years […] It is not achievable. It is not realistic, and that is a problem because if it is not realistic, people are not bought into it […] I do not think the manufacturers will be in a place to supply 1 million [or] 100,000 EVs every year for the next nine years." (Respondent 34, EV user and automotive sector employee)

Under business-as-usual conditions, per Respondent 34, the Irish market could not supply the required volume of EVs. In addition, supply constraints have been a significant issue over the past number of years in Ireland's automobile market due to the global semiconductor shortage and changing trade relations with the UK due to Brexit. E-way 2040, then, argued for a fleet replacement approach to decarbonise transport in Ireland, whereby newer internal combustion engines, with improved emissions standards, would replace the existing fleet. The fleet replacement approach would be driven by reducing or removing vehicle registration tax with a view to promoting new vehicle sales. Thus, acting as a bridge to lower transport emissions until 2040, when the Irish government, CPOs, and the automobile market could deliver the scale of action needed for a deeper EV transition. According to Respondent 63, who was a member of ICCRA, the e-way 2040 campaign had the support of the majority of dealerships across the country:

> “We had over 70% participation from retail dealers in the country […] [Dealerships were] pointing out deficiencies in policy, and because it goes against the narrative that's been talked about at the moment, then, [the government] can't be seen to be against the green agenda […] The targets that we've set ourselves in transport are going to fail […] The amount of electric vehicles that we're registering, full battery electric vehicles that we're registering, at the moment is being surpassed by about seven to one by used imports. That's completely negating any advances that we've made, and you make these points to them, and they just bury their heads in the sand…” (Respondent 63, automotive sector representative)

Per Respondent 63, the automobile firms that were tasked with delivering on the EV target were unsupportive of the government’s strategy. Beyond these public-private tensions, however, EV users such as Respondent 1, argued that the presence of Volkswagen dealerships in ICCRA stood out and indicated the tensions between how automobile organise their interventions across a variety of scales:

> “So, if you google E-Way 2040 […] The government’s goal is 2030, and they want that in 2040 […] behind it is a group of dealers. Mostly, Volkswagen and Audi dealers […] This is a bit uncomfortable, especially for Volkswagen, because Volkswagen as a company put so much money behind electrification, but then you’ve got local dealers who put themselves together just to go against that […] Those dealers are threatened because electrification asks them to invest in their sales force, invest in hardware and software to maintain different cars, and

> it is a threat because electric vehicles require very little maintenance and dealers are making a lot of money on car maintenance. So, that'll be a revenue stream that gets lower and lower. So that's a true problem for them…" (Respondent 1, EV user)

For Respondent 1, Volkswagen Global's move towards electrification was being resisted by the demands of its dealership on the ground in Dublin. However, we *also* know that Volkswagen Global had called for growth in ICE sales to 'finance' the transition to EVs. In fact, per Respondent 63, ICCRA sought to enrol the support of firms such as Volkswagen Global in their lobbying efforts to contact the Irish government, but Irish politicians ultimately dismissed the proposal:

> "We made an offer, through me […], to bring the head of the EV Transition Network of Volkswagen Group […] to Dublin to talk to any politician and to talk to the Climate Action Committee […] I have people in Germany saying to me 'well, what did they say when you made that offer?' And I said, 'well, I didn't even get a response.' […] They looked at it as a bit of an insult […] Are they afraid of what the biggest manufacturer in Europe is going to say? Or maybe because Volkswagen have the history with the emissions scandal that they didn't want to conflate the two…" (Respondent 63, automotive sector representative)

There is evidence, then, that global automobile firms such as Volkswagen have been willing to engage with local economic agents to increase the sale of EVs. Yet, the automobile sector has been largely absent from efforts to roll out infrastructure. Consider Respondent 1's argument that the reason charging infrastructure was not being rolled out was due to the lack of EV sales:

> "[The inertia around the turn to EVs is] a chicken and egg issue, like with everything. Fast chargers are much more expensive to install, so you need more customers going there. If there are no people looking

> for [chargers] you won't have them installed. It's happening, but it's gradual. We'll get there, but it's how fast can we get there that's the problem." (Respondent 1, EV user)

Per Respondent 1, the infrastructural component of Dublin's EV transition has lacked any real coordination with efforts to expand EV sales. A crucial point here is that automobile manufacturers were reluctant to fully engage with the development of EV infrastructure. Tesla and Ionity have rolled out charging networks of their own with the backing of automobile firms, but their networks have limited capacity and are considered 'premium providers' within the charge point operation sector. For Respondent 67, the automobile firms appeared to be waiting until indigenous firms or the state to mobilise infrastructural developments:

> "One of the questions we'd be discussing internally is why aren't the car providers coming to the market, or to the fore, to do something [in the EV infrastructure space]? They'll turn around and say, 'well my job is to sell a car'. That's fine. But, if fuel, a different type of fuel is as part of that, you have to come up with something […] they all seem to be waiting on ESB ecars to do things." (Respondent 67, local authority representative)

The automobile sector, for the most part, is keeping away from the localised interventions required to develop infrastructure. They are waiting on local and (in the case of Ireland) publicly funded firms, (i.e., ESB ecars) to create the necessary arrangements needed to develop EV infrastructure. The challenge for local firms is to justify the investment in infrastructure without having a high-level of EV penetration. In other words, building before demand. Yet, the cases above demonstrate how automobile firms continue to obfuscate the pathways towards EVs across a variety of scales. Thus undermining the EV sales with a view to maximising profits from ICE sales.

I now turn to consider the implications of these inconstant interventions on the development of insufficient infrastructure. The development of longer-range EVs resulted in growing calls for high-speed charging infrastructure, as previously mentioned in section 5.3 above. Yet, installing DC infrastructure is a capital-intensive process that, in turn, creates significant barriers in the way of investment. Consider Respondent 49:

> "…you take DC chargers, the price of them straight away enter thousands of pounds or tens of thousands of pounds. But if you want a 300-kilowatt rapid charger, it's the same process with the grid as putting up a wind turbine potentially. That's the amount of power. You have to think of the earthing, you have to think about substations, you have to think fault levels down here going back to the main substations […] it's a massive undertaking." (Respondent 49, charge point operations representative)

The issue was not that the volume of capital was unavailable to charge point providers, although the cost of providing high-speed charging is prohibitive, but rather that the turnover times for investment were protracted. For example, Respondent 52, who had worked in the electricity sector, argued that he could not justify the business case for installing infrastructure because the payback could potentially take years:

> "It's very hard selling to the managing director of an energy company that's going through the wars at the moment, like every other energy company [and say,] 'if you could give us 20 [million], we'd make a success out it', when you get your payback in about eight years…" (Respondent 52, energy sector representative)

In addition, issues with turnover times were also expressed with low occupancy turnover rates because of low levels of EV penetration in the transport system. For Respondent 57, one way he could circumvent some of the challenges regarding installation was to install charging infrastructure of a maximum speed of 50-kilowatt hour. This maximum speed meant his firm would not have to apply for planning permissions. However, the growing push for higher battery ranges was placing pressure on his existing business model:

> "We've gone down a slightly different route with the 50-kilowatt charge points solely because we don't have to put in a substation, which means we don't have to apply for planning permission, which means we can get a direct connection from ESB, sit it on a certain DG level that makes it affordable. We'd love to go with 150 [kilowatt hour] charge points but we'd have to apply for planning permission for the charge point, we'd have to apply for planning permission for a substation, the cost involved in doing that. And suddenly you're gone from it cost us in the region of 45 grand to drop a charger onto the ground now. Otherwise, you're looking at in the hundreds of 1000s. That's a huge barrier to entry for companies, particularly when you're trying to sell electricity at 35 cents a kilowatt in the hope that somebody shows up to buy." (Respondent 57, charge point operations representative)

Per Respondent 57, there is a sense that CPOs are waiting 'in the hope that somebody shows up to buy it' due to the immaturity of the market. Another key point here is that maximum import capacities and connection charges are hindering the development of EV infrastructure. In other words, rents are undermining the accumulation prospects of CPO firms. Respondent 58 highlighted this point:

> "…in terms of the infrastructure itself the payback is a key factor […] for commercial EV chargers there's a certain amount of redundancy with these units, they're not being used a lot of the time […] if we want to go out and say 'well we're going to install 20 of these, make a plaza with 20 these', we're going to be a long time getting our money back and what effects of the payback is the current use of system charges.

> So, [with] an EV charger, the higher the wattage of the charger, the higher the maximum import capacity (MIC) required […] the more upgrades that are needed to an area and the higher the monthly charge that's due. Even if it's not used at all, you're still paying an exorbitant amount for use of systems charges […] these ultra-fast chargers and rapid charges, it's eye-watering because they're not going to be used 24 hours a day, they're going to used maybe at the maximum six or seven hours a day at the moment…" (Respondent 58, energy sector representative)

I argue that this novel relationship between rents and accumulation is worth noting because it demonstrates a vital and messy terrain that smaller firms in Ireland must navigate. Accordingly, key sectors are reluctant to enter the CPO space. For example, Respondent 68 noted how forecourts, which traditionally provide fuel have been reluctant to enter the space:

> "So, why would we not say to the forecourts 'great, how can we enable you to make that transition over to start providing charges on your forecourts?' […] I suspect the real issue is the cost of grid connection and the available capacity. I'd say the forecourt operators see this already […] the private sector is very responsive, it will be done overnight if possible if they think there's a buck to be made, and it is a way of keeping the business going in the right direction strategically…" (Respondent 68, local authority representative)

There is a sense that CPO operators are waiting until the EV market expands, but as charted above, the interventions made by automobile firms at a variety of scales are not progressing the transition at a coordinated rate. For Respondent 58, the upshot is a wild west expressed via market play.

> "…it's in its infancy, but it's also a bit of a wild west. There's no real policy regarding that or no willingness to look at it in detail. So what

> is happening is people making a play in the market going right this is what we're going to do, install as many of these possible, and we'll get the mess sorted out that later […] I don't think it's even fair to say that energy companies or electricity companies here have any real idea of what the long-term view is but they're just trying to make a bit of a play at the moment…" (Respondent 58, energy sector representative)

There were, however, strategies that the private sector could leverage to raise the capital to circumvent the accumulation barriers highlighted in this section. A key strategy, as identified in Section 6.2, was to leverage the subsidies made available by the state. Since my fieldwork completed, the Irish state announced further infrastructural subsidies, for example, the Shared Island Sports Club EV Charging Scheme is a new €15 million scheme aimed at providing infrastructure at sports clubs (see: gov.ie 2023). In addition, the Electric Vehicles Charging Infrastructure Strategy 2022 – 2025 aims to allocate €100 million in funding to support investment in public charging infrastructure (see: Department of Transport, 2022). These publicly funded schemes, I argue, are a far cry from the market-oriented development that commercialisation was supposed to deliver.

Another strategy is signposted through so-called 'premium providers', such as Ionity and Tesla, who designed their networks around high-speed charging but with higher tariffs. By charging EV users more, premium providers can ameliorate some of the tensions around the cost of installing and operating charge points ahead of demand. These networks are quite limited in Ireland, for example, Ionity operates four hubs across Ireland. Many respondents argued that these networks were cost-prohibitive. Consider Respondent 9:

> "I've never used the Ionity ones and the primary reason I've never used those is because they're ridiculously expensive. When I first got the Tesla, they had really good rates […] but that all changed now and they're like there charging rates are something ridiculous." (Respondent 9, EV user)

At the same time, other respondents, such as Respondent 47, argued that using premium providers was better ‘time-for-money:

> “I drive a lot in an EV, you know, today I left home, I drove to Shannon […] I didn't have time to be stopping […] and spending a lot of time at a slow charge point. So, I charged at an Ionity [charger]. It was expensive to charge up for the amount of power I put in. But you know what I was in and out of Ionity in 30 minutes and it allowed me to go about my day. Did I worry about the cost? […] Yeah, it is a bit expensive but, then again, the time that I had today was more valuable than the cost of that.” (Respondent 57, charge point operations representative)

I argue that the experiences highlighted by the two respondents above shed light on new forms of fragmentation that are emerging within Dublin’s EV charging network. For example, EV users with access to higher incomes do not have to navigate an inadequate, incoherent, and inconstant urban scene if they can afford premium providers. In fact, other EV users, such as Respondent 28, argued that going forward, Dublin is likely to experience two classes of EV users:

> “If within 10 years […] the majority of new cars are electric, it is going to be very, very hard to charge outside the home. It is going to be a challenge. It already is. Unless you go for those premium providers […] But I would be very surprised if those premium providers do not remain premium for a reason and the only car that you see there are Porsche Taycans, Mercedes, and Jaguars, and maybe the odd Tesla, that is too far away from one of the superchargers. Every other car will be queuing on one of the ESB chargers and you will see two speeds in terms of status of EV drivers, the ones who have the nice Porsche cars that go to a Ionity and then you have everybody who queues at an ESB fast charge point.” (Respondent 28, EV users)

Per Respondent 28, a key outcome of efforts to ameliorate the tensions surrounding the inadequate infrastructure and its associated costs is to fragment access to the spaces along socio-economic lines. I revisit this point in my discussion in Section 6.5. Next, I want to zoom in on the dynamics of a specific CPO through a case study to examine how the inconstant and insufficient interventions made by the private sector hinder the development of a decisive and timely decarbonising project.

5.4 Case study: the inner workings of CPO firm 'ChargePal'

ChargePal[10] is an Irish charge point operation (CPO) firm which began circa 2013 as a residential EV charge point installation company. The firm entered the public charging network segment of the EV industry in 2018, around the time ESB ecars' commercialised its EV charging network. By 2021, ChargePal was operating a distributed network of charge points across the island of Ireland, employing approximately 20 people, with the bulk of its operations managed in-house, e.g., installations, maintenance, and backend support. The firm's initial business model sought to lease smaller spaces from landowners for 15 to 20 years, for example, in car parks. ChargePal's approach was to rent the land to host standard 7-kilowatt AC charge points, 22-kilowatt AC charge points, and a maximum of 50-kilowatt hour DC chargers. The reason ChargePal operated at a maximum speed of 50-kilowatt hours was that 50-kilowatt installations did not require additional power to be re-routed from the grid. This decision allowed ChargePal to avoid, in some cases, additional planning permission and, in other cases, installing infrastructures, such as substations. In 2021, however, ChargePal decided to change tack. The company had received funding from three major foreign equity investors with a view to developing an additional 500 chargers across Ireland. These chargers were to consist of 50-kilowatt hour DC chargers and a more complex set of 75-kilowatt hour DC chargers. On the foot of having received the funding, ChargePal partnered with one of Ireland's largest telecommunication companies to expand its network

[10] Not its real name.

and had begun working with local authorities to develop EV infrastructures in their administrative areas.

The same year was a crucial year for Dublin's EV infrastructure; the sum of EV licenses in Ireland rose by 8,554 to a total figure of around 19,157; ESB ecars had introduced tariffs across all charging types and was pursuing its 'upgrade programme'; however, the global picture was markedly unstable for the EV industry. The Covid-19 pandemic had disrupted supply chains and constrained access to essential equipment and parts; factors such as Brexit had added to the supply-chain shocks, particularly in Ireland, where many charge point operation firms were forced to reorganise logistically to secure a steady supply; and in Ireland, the government was under criticism for its lack of progress in expanding EV sales and developing the associated infrastructure.[11] ChargePal's efforts to expand the size and speed of its network developed in the context of this wider backdrop. I want to examine two aspects of their interventions.

The first concerns the regulatory and planning regimes that hindered ChargePal's ability to act in a timely and decisive way. Consider that in 2021, ChargePal began to ramp up its relationship with local authorities. The firm had already been struggling against the local authorities in their efforts to install EV infrastructures due to what the firm felt was an overly bureaucratic planning process. Thus, when the opportunity emerged to work with the local authorities, ChargePal's director expected that the relationship would help to expedite the development of infrastructure. However, when the firm began to engage with the local council, the process was often drawn out over a long period of market inquiries and meetings, which strained the relationship. As Respondent 57 noted:

[11] For example, a report from the Association for Renewable Energy and Clean Technology (REA, 2022), which assessed European countries' readiness to meet their 2030 decarbonisation targets, scored Ireland among the lowest of any country when it came it EV charging infrastructure, stating that "Electric vehicle and charging infrastructure rollout is slow [and the] benefits are not yet emerging (p. 41)."

> "…when we make a proposal to a council […] there's multiple meetings, upon multiple meetings, upon multiple amounts of data shared, and it is very time consuming with no consultancy fees […] with a council you're talking six months before anything happens […] Of course, they're always going to be restrained by the politics, I suppose, of having to get in quotes and run pilot projects […]" (Respondent 57, charge point operations representative)

ChargePal found that the relationship frequently revolved around pilot projects which would reduce the likelihood of engaging in high-impact work. Moreover, their interactions were often isolated to market inquiries aimed at developing infrastructure in spaces which were untenable due to the lack of existing electrical infrastructures, such as cabling. Where interactions with the local authorities had made progress, ChargePal often found themselves in competition with other CPOs, which often resulted in the firm losing the tender. ESB ecars were a particularly difficult competitor in this regard because the firm could leverage subsidies and public funding to provide infrastructure at what ChargePal felt was an uncompetitive cost.

A second issue concerns the market dynamics of high-speed chargers. In 2021, the trends in EV battery size indicated that AC standard charging would become less suitable across public charging networks. Automobile manufacturers had begun the process of shifting towards long-range EVs as the market standard; EV users were calling for faster chargers. A crucial point here is that high-speed DC chargers are bespoke technologies, in other words, manufactured upon order. This aspect of the production process exacerbated the timelines of when firms could receive the necessary stock because the manufacturer was incapable of providing just-in-time deliveries due to supply chain disruption. At the same time, the business case for high-speed charging was more difficult to justify. EV sales had not yet expanded to a point where the occupancy rate at charge points were high. Firms such as ChargePal were installing units at the risk that EV users might not turn up at the necessary rates to warrant the costs. Consider Respondent 57:

> “[We installed] 50 kilowatt chargers solely because we don't have to put in a substation, which means we don't have to apply for planning permission, which means we can get a direct connection from ESB […] We'd love to go with 150 kilowatt chargers but […] suddenly you are gone from it costing in the region of €45,000 [to] looking at hundreds of €1000s. That's a huge barrier to entry for companies, particularly when you're trying to sell electricity at 35 cents a kilowatt in the hope that somebody shows up to buy it.” (Respondent 57, charge point operations representative)

If the issue stemmed from the high-capital costs of high-speed DC charging units, then it was exacerbated by the connection chargers that charge point operators would have to pay for the availability of power at their chargers. Charge point operators pay connection fees to ESB ecars on the basis of maximum import capacities (MICs). The higher the power, the higher the MIC-related fees. However, the issue for ChargePal was that they had no assurance of service to accurately assess their capacity to pay for the MIC-related fees. What we can see here is ChargePal are consistently burdened by the need to build before demand; the incoherence of the wider EV project hinders the ability of the firm to gauge the investment case.

In sum, the case of ChargePal is illuminating because it demonstrates how market forces operating on a global scale exert pressure on local economic agents operating in smaller firms and alongside the state to deliver on the type of place-specific infrastructure decarbonisation requires. Failure to coordinate the project across a range of scales ultimately hinders the scope for meaningful decarbonisation to occur. The result is a type of shallow decarbonisation or greening, which only scratches the surface of the type of action needed to avoid environmental catastrophe.

5.5 Discussion

Drawing on Marxist approaches to urban development, I examined the ways in which automobile and CPO firms, alongside the Irish state, pursued inconstant and insufficient interventions. I demonstrated how the actions they pursued have failed to produce a type of restructuring project capable of delivering the scale of action needed for meaningful decarbonisation. In this section, I argue that this inadequacy – this lack of any dominant vision or action – needs to be understood as emerging in the context of 'actually existing neoliberalism' in Dublin (see: Hearne, 2014; Mercille & Murphy, 2019). Examining the geographies of neoliberalism demands that we pay attention to "the contextual embeddedness of neoliberal restructuring projects insofar as they have been produced within national, regional, and local contexts defined by the legacies of inherited institutional frameworks, policy regimes, regulatory practices, and political struggles (Brenner and Theodore, 2002, p. 342)." In this regard, I ask: how do the locality-specific forms and consequences of neoliberalization give rise to configuration failures in Dublin's EV project? I have three points to make.

First, I argue that the role of the Irish state demands attention, particularly through the ways in which tensions within the Irish neoliberal model undermine the turn to EVs. According to Harvey (2005, p. 64), the role of the state in neoliberal theory is easy to define, but "…the practice of neoliberalization has, however, evolved in such a way as to depart significantly from the template that theory provides." The public sector interventions charted out in Section 6.2 above – ESB ecars' push to commercialise the infrastructure and the local authorities' efforts to outsource developments to the private sector – are both classic neoliberal approaches to urban development. Yet, under close examination, per Harvey, they 'depart significantly from the template that neoliberal theory provides.' Moreover, I argue that the inconstant and insufficient characteristics of these interventions resonate with Peck and Theodore's (2019, p. 247) observation that neoliberalization is "in an ongoing state of contested reconstruction […] its reactionary face always being consumed (if not defined) by context-specific struggles, rollbacks, and flawed experiments."

There are structural issues and relationships that awkwardly bound the Irish state to neoliberalism. At the global scale, Ireland's post-industrial economy relies upon free trade agreements to import industrial goods and services that support its domestic economy; at the regional scale, Ireland's position within the EU often requires that the state transpose liberalisation policies;[12] and at the national scale, decades of neoliberal policies have weakened public sector institutions to a point where public sector actors feel as if 'there is no alternative' outside of the neoliberal model. Along similar lines to Boyle et al.'s (2023, p. 200) comment on the UK landscape, Irish public sector actors operate within "…a constrained choice architecture cultivated over decades thanks to a hegemonic commitment to orthodox neoliberal thought." This constrained choice architecture was evidenced in Section 6.2, where a history of budget cuts and limited workforce planning associated with austerity limited the capacity of the Irish state to enact decarbonisation efforts sooner; and via the marketisation of public sector interventions across a variety of scales. I have highlighted evidence in Section 6.2 of the ways in which the costs associated with developing EV infrastructure compelled the Irish state to pursue a market-oriented approach to decarbonisation, specifically when the CRU authorised ESB ecars to commercialise the EV charging network with a view to expand and upgrade the infrastructure. I have also provided evidence of the central state's efforts to rescale the responsibility of developing EV infrastructure to local authorities, which prompted the creation of new public-private partnerships intended to supply new revenue streams to Dublin's local authorities.[13] The effectiveness of these market-oriented shifts, however, have been hamstrung by the risk-averse structures and governance of the public sector. For example, via governance measures aimed at cost containment or

[12] Consider the EU liberalisation directives that have shaped Ireland's energy sector. For example, the 1996 EU Directive 96/92/EC, known as the First Energy Package, prompted efforts to disband ESB's monopoly over the country's energy market with a view to increasing competition (Gaffney, et al., 2017). In addition, the liberalisation directive EU 2019/944 on the common rules for the internal market for electricity shapes the dynamics of Dublin's EV project, as previously mentioned in Section 6.2 above.

[13] Harvey (2013) observes that "…capitalism never solves its crisis problems, [but] moves them around geographically." The failures of the Irish state's efforts to geographically rescale the responsibility of climate action resonates with this observation.

minimising the risks of investing 'too soon' into nascent technological regimes. These interventions are, per Peck and Theodore's (2019, p. 247) observation, in an inconstant state of "contested reconstruction." The upshot, I argue, is the emergence of new institutional and governance structures that, in name, are responsible for the decarbonising project but struggle to manage environment-economy tensions at a range of scales.

Further, according to While et al. (2010, p. 80), the decarbonising process necessarily entails 'eco-state restructuring' or "…the reorganisation of state powers, capacities, regulations and territorial structures around institutional pathways and strategic projects, which are […] viewed as less environmentally damaging than previous trajectories." 'Actually existing' neoliberalism in Dublin leads the state to produce and draw upon an entrepreneurial toolkit that is incapable of delivering an eco-state restructuring project. This entrepreneurial toolkit does not resemble a calculated or considered approach to decarbonisation; rather, it reflects what Harvey (2005, p. 3) describes as 'common-sense understandings' in capitalist societies, in which neoliberalism has grown to be "… hegemonic as a mode of discourse […] to the point where it has become incorporated into the common-sense way many of us interpret, live in, and understand the world."[14] In short, relying on the market has become an axiomatic policy response in Irish governance (see: Fraser, et al., 2013; Moore-Cherry, 2020)

Second, although the state looks to the market to play a leading role in decarbonising the city, my findings demonstrate that interventions pursued by the private sector reflect the dynamics of capitalist accumulation to place a limit on firms to produce the scale of action needed to decarbonise. The core issue here is that, at the heart of any neoliberal project is a sense that markets and market signals can best determine the allocative decision of resources, goods, and opportunities in a society; that the environment is external to this market system; and that capitalists can accumulate for accumulation's sake without any deep concern for

[14] Harvey (2005, p. 3) adds that common-sense "…is not the same as the 'good sense' […] [and can be] profoundly misleading, obfuscating or disguising real problems under cultural prejudices."

sustainability objectives (see: Harvey, 2005, p. 67). I argue that while decarbonisation fundamentally alters these sensibilities, the private sector interventions I examined in Section 6.3 above demonstrated how a distorted version of these logics obtains. Toyota and Nissan's competition around hybrid technologies, in which environmental objectives are not so much 'externalized' from the market system, but obfuscated and subjugated in production in ways that allow automobile firms to valorise decarbonisation while exerting control over its forms and frames. The competition over hybrid technologies develops out of efforts to greenwash production but *also* from the 'coercive laws of competition' that compel capitalist firms to pursue accumulation and profit maximisation, regardless of social or environmental harms, because their long-term accumulation strategies embed certain types of capital-labour relations that cannot be abandoned in the timeframes that decarbonisation require. Indeed, as Harvey (2010, p. 146) argues, "no matter whether they are good- or bad-hearted, capitalists are forced by competition to engage in the same labor practices as their competitors." Thus, Nissan was compelled to engage in the same labour practices as Toyota, compelled to prolong the production of ICEs due to the success of self-charging hybrids. To the extent that the market can 'best determine' the allocative resources to transition from fossil-based production to zero-carbon alternatives, the interplay of Nissan and Toyota signposts a core element of the configuration and transition failure that defines the current political, economic, and environmental crisis.

A crucial further point here is that oil has been "the lifeblood" (see: Huber, 2013) of the capitalist mode of production for nearly a century, with many technical and social interlinkages with other institutions, industries, and related occupations (Mitchell, 2011). These path dependencies are not easily shaken in a 'system of automobility' defined by fossil fuels. The regulations set out by the EU, to ban the sale of new diesel and petrol engines from 2035, go a long way to encourage a shift in production. Yet, Section 6.3 shined a light on the interventions by the private sector aimed at circumventing and altering these regulations, for example, via Volkswagen's lobbying efforts to introduce e-fuels or via their efforts to expand ICE sales to fund the transition to EVs. As a result, polluting engines will likely remain in second-hand and used car markets past the 2035 ban. Automobile manufacturers need to shift from fossil-based production towards a system designed around EVs. In tandem, a planetary-wide but locality-specific set of actions to encourage the production and sale of EVs is needed. Automobile firms need local actors to embed new infrastructures and to form flows of capital and social dependencies around those infrastructures to create the conditions for accumulation. In the context of Dublin, my evidence shows that automobile firms are largely indifferent to how these infrastructures develop, although they have exerted *some* pressure on locality-specific agents to configure the infrastructure around the technical and energy demands of the latest EVs, for example, the production of long-range EVs requires higher charging speeds. I have examined the ecological implications of this push for longer-range in Chapter 4.

Third, the dynamics of this push for longer ranges is ineffective in provoking the necessary scale of action needed for meaningful decarbonization. In fact, this push, I argue produces local configuration failures in Dublin's EV sector, whereby CPO firms in Dublin struggled to develop a coherent accumulation regime around EV infrastructure. Their efforts have lacked any real coordination with the expansion of EV sales and with shifts in the technical demands of EV technologies. Indeed, these shifts in innovation, driven by automobile manufacturers operating at the global scale, have given rise to what Storper and Walker (1989) might refer to as "capital's inconstant geography" that comes to ground in Dublin's EV sector in chaotic ways. In this inconstant geography, CPO firms have been forced to re-orient their focus from a portfolio based on AC standard charging to DC high-speed charging to acquiesce to the emergence of long-range EVs. However, in Dublin, these efforts have been unsuccessful because CPO firms, such as ChargePal (examined in Section 6.4), have confronted barriers in their efforts to generate the necessary flows of capital to develop high-speed charging infrastructure.

A reason that goes a long way to explain why these barriers exist relates to the capital-intensive nature of high-speed charging. As charted out in Section 6.3, the challenge is not so much that the technologies are ‘too expensive’, although that is certainly a key aspect; but rather that firms struggled to achieve sufficient turnover times to justify the investment. The low levels of EV penetration in Dublin’s automobile market meant CPOs were operating in a context where service was not assured. Moreover, firms were investing ahead of demand in ‘the hope that EV users would show up’ but were still required to pay the higher rents associated with connection costs of high-speed. CPOs reported that the return on investment under current market conditions could take years. In turn, key players in Dublin’s transportation and energy sectors have been reluctant to ‘move too soon’ into the EV space until a more dominant EV project emerged.

There were methods that enabled the EV sector as-a-whole to circumvent the barriers to accumulation they encountered in Dublin. I argue these methods shed light on the contradictory nature of ‘actually existing neoliberalism’. The first method that stood out was to develop the infrastructure by raising capital from subsidies and tax breaks supplied by the Irish state. The case of ESB ecars and Dublin’s local authorities in Section 6.2 highlighted the ways in which this strategy was deployed to bolster the private sector. The second way the EV sector circumvented the barriers to accumulation was via the introduction of premium charge points aimed at fragmenting access along socio-economic lines. In other words, the market dynamics of EVs sought to (re)produce what Graham and Marvin (2001) refer to as ‘splintering urbanism’, which refers to how “…infrastructure networks are being ‘unbundled’ in ways that help sustain the fragmentation of the social and material fabric of cities (p. 33).” Crucially, efforts to develop EV infrastructure sought to leverage the political-economic project of decarbonisation to disguise a project designed to restore class power, a theme I develop further in Chapter 6 in where I examine how Dublin’s turn to EVs reflects efforts by capitalist classes, in alliance with the neoliberal state and socio-economic elites, to make claims over the future of the city.

5.6 Conclusion

Dublin's EV project, then, produces and draws novel connections between the state and capital. This chapter examined the public and private sector interventions aimed at steering the pathways towards EVs. Drawing on Marxist literature, I examined the ways in which the interplay between the state and capital seeks to reproduce the conditions for accumulation in cities. I argued that Dublin's turn to EVs has been deeply shaped by *inconstant and insufficient interventions* by the public and private sectors. In this regard, "capital's inconstant geography" (see: Storper and Walker) is shot through the modes of regulation and regimes of accumulation that underpin EV transitions. My analysis shed light on the structural issues and relationships that bound the public and private sectors to 'growth first' strategies that hinder the capacity for decisive and timely decarbonising action to take shape. I argued that this commitment to a form of 'roll-with it neoliberalization' (see: Keil, 2009) resembles to a 'dead but dominant' market-oriented approach or what Peck (2010) refers to as 'zombie neoliberalism', where "The living dead of the free-market revolution continue to walk the earth, though with each resurrection their decidedly uncoordinated gait becomes even more erratic (109)." Any faith in the promise of neoliberalism has died. Still, the project keeps stumbling on, with far-reaching and destructive consequences.

Overall, the CUTS framework I developed draws upon Marxian approaches to urban development for good reason. The multi-level perspective (MLP) and urban political ecology (UPE) have utility for researchers aiming to critically examine the niche-action and nature-society relations that shape transition in urban contexts. However, Marxian approaches to urban development, I argue, provide the most explanatory power for understanding the causal structures that shape transitions. I have demonstrated how a Marxist approach can help to shed light on ways in which struggles to balance the environmental and economic objectives relate to shifts in the dynamics of capitalist accumulation. Moreover, I have highlighted how these struggles seek to shape our present urban system in the image of firms and economic elites (who, then, make claims over the futures of cities). I argue, the value that Marxian approaches to urban development offer

CUTS relate to how this approach uncovers the role of class power in driving urban transitions. In the next chapter, I examine the fourth core finding of my research: the imaginative iterative responses by users. My aim is to move towards understanding the odd structure of class relations involved in the formation of new accumulation strategies, spaces and fixes capable of holding together, for a time at least, some of the tensions emerging from the chaotic unfolding of EVs and associated infrastructures in cities.

Chapter 6 Cross-class alliances and the rise of electric vehicles in Dublin

6.1 Introduction

Dublin is in the midst of an intense period of socio-spatial restructuring associated with the expansion of various forms of so-called 'decarbonizing' technologies. This is similar to the kind of restructuring unfolding in Amsterdam (Mashhoodi & van der Blij, 2021), Beijing (Jin, et al., 2020), and Norway (Sovacool, et al., 2019a; 2019b). Local authorities, firms, and residents are installing new infrastructure such as rooftop solar panels; some of the existing housing stock and many new housing developments are moving towards the use of air and ground source heat pumps; and there are now around 15,000 zero-emission vehicles using Dublin's streets (SIMI, 2023).[1] Less noticeable is another geography in formation, which supports the decarbonizing city via the installation of new digital infrastructures; the roll-out of maintenance and repair systems; and even the emergence of new socio-ecological transformations in and beyond the city aimed at securing a reliable and expanded flow of electricity (Bresnihan & Brodie, 2020; Dunlap, 2020). A 'decarbonizing city' might be taking shape in Dublin, but it emerges in relation to a wider and heavily contested arena of spatial transformation.

Efforts to respond to climate change go a long way to explain developments in Dublin and cities like it. The Irish political economy exists in the context of a wider European project, which in recent years has begun to develop new climate action initiatives, such as the European Union's 'Fit for 55' proposals, one element of which seeks to reduce net greenhouse gas emissions by at least 55% by 2030 (European Council and Council of the European Union, 2022). The Irish government has passed a Climate Act (Oireachtas, 2021a) and a Climate Action Plan 2021 (Department of the Environment, Climate and Communications, 2021); Dublin City Council has adopted a Climate Action Plan 2019-2024 (Dublin City

[1] 'At least' because 34,693 zero-emission vehicles have been registered in Ireland and 16,266 registered in Dublin since 2010 (SIMI, 2023).

Council, 2019); and Codema, which refers to itself as "Dublin's Energy Agency," has recently published an Energy Master Plan (Codema, 2021) as part of its remit to provide "energy and climate mitigation services to the four Dublin Local Authorities" (Codema, 2022).

At the same time, it is important to view developments in Dublin in the context of a so-called 'green industrial revolution' (Clark II & Cooke, 2015) led by capitalists in manufacturing sectors. Cloaked in the language of sustainability, obscuring their historical role in creating the climate problem, and enabling them to remain in the driving seat of the capitalist economy, the green industrial revolution entails new rounds of investment that, in turn, require reconfiguring cities such as Dublin. Nevertheless, the green industrial revolution, in myth or reality, demands that new geographies are established, that urban systems are re-formulated, so that extant processes of exploitation and capital accumulation are left untouched.

Against this general backdrop, the following paper focuses on the emergence of a new geography in Dublin oriented around facilitating the sale and use of electric vehicles (EVs). EVs have become the de facto standard for decarbonizing transportation in cities, as evidenced by the IPCC's (2022a, p. 41) claim that "electric vehicles [EVs] powered by low emissions electricity offer the largest decarbonization potential for land-based transport." The automobile sector, which employs at least 20 million workers around the world (Dicken, 2015) and constitutes on its own a $3 trillion industry (Carlier, 2022) is beginning to restructure around the production of EVs, even if a significant proportion of its sales continue to be Internal Combustion Engines [ICE].[2] According to a report by Reuters (2022), automakers will have invested $1.2 trillion in EV production by 2030, in part as a response to new entrants such as Tesla but also due to the likelihood of stricter emissions standards, such as 'Euro 7,' which the European Commission (2022) claims will "drive the deployment of zero-emission vehicles."

[2] According to the European Environmental Agency (EEA, 2021), for example, ICE sales accounted for 82.2% of all new vehicle registration in Europe.

The shift toward EVs has attracted attention from geographers. For example, Henderson (2020) has argued that EV drivers – who he refers to as “kinetic elites” (p. 1998; citing Birtchnell & Caletrío, 2013) – leverage the decarbonizing project to reproduce highly uneven, private, and hypermobile transport regimes. At a global scale, Henderson suggests that EV production and consumption “might escalate rather than reduce global resource and energy demand” (2020, p. 1993) by placing new demands on critical raw materials and electricity grids. At the urban level, he argues that EV drivers demand a city that undermines other, conceivably more sustainable forms of transport. Others such as Kester (2018) focus on the role of EV infrastructures in reshaping governmental practices regarding energy security. He posits that EV charge points merge the automobility and electricity systems, thus requiring new security practices to enable the circulation of energy and transport. Further contributions examine ‘niche innovation’ and experimentation in transportation systems using the so-called ‘multi-level perspective (e.g., Geels, 2012; Berkeley, et al., 2017).’

Hitherto, Marxist geographers have not paid enough attention to these sorts of developments. Yet, there are some significant contributions that signpost a type of approach that might provide effective explanation. While, et al., (2010; 2004), for example, draw on Marxist literature on the politics of local economic development to elaborate upon efforts to produce ‘socio-ecological fixes’ to capitalism’s social and environmental crisis tendencies. Their argument shines a light on the emergence of cross-class coalitions in specific localities and regions, which try to anchor so-called ‘sustainable’ innovations in cities while reproducing inequality and expanding the scope for capitalist accumulation to occur. As they suggest, the notion of a ‘sustainability fix’ draws upon the argument that “the geographical reproduction of the capitalist mode of production depends on uniting territorially based class interests and factions behind a coherent line of action” (While, et al., 2004, p. 551). Geographical analyses of EVs in the decarbonizing city tend to play down the relations between EV drivers and automobile firms. In contrast, I argue that emphasizing the role of cross-class alliances in producing the decarbonizing city permits a type of analysis that calls attention to projects and plans that reflect a type of ‘eco-state restructuring’ (While, et al., 2010, p. 77) that emerge from capitalism’s need for socio-ecological fixes of this nature.

In the following paper, then, I draw on an analysis of qualitative fieldwork on the dynamics of Dublin’s EV shift to theorise the uneasy and, at times, odd structure of class relations driving the decarbonising city. I argue that capitalist enterprises – corporations such as Volkswagen or Nissan – cannot alone produce the complex geographies required to expand their accumulation prospects. Instead, they rely on developing and analysing an ongoing iterative arrangement with EV drivers, as well as numerous smaller firms. I therefore argue that automobile firms need to be understood as working with, drawing upon, and exploiting an implicit but effective alliance with EV drivers to restructure transport systems across cities like Dublin and thereby create new infrastructures such as charging points while establishing unique socio-cultural and institutional mixes. The rest of the paper has two main sections. I begin by elaborating on the argument that the expansion of EVs requires cross-class alliances. I then draw on my research findings to examine the chaotic experiences felt by EV users at charge points in Dublin and how they respond to the problems they encounter. I shed light on a range of creative and strategic actions EV users express to address infrastructural failures while shaping the city in their own image.

Data for this paper are based on primary research I conducted in 2021, following approval from the Faculty of Social Sciences Ethics Committee at Maynooth University (approval identification number 2417100). I decided to focus on EV users because they are actively engaging, and at times creating, the emerging geography of the decarbonising city in Dublin. They experience and try to find solutions to infrastructural problems, for example, regarding charging points. They can provide first-hand, direct accounts of what it is like to own and use an EV in Dublin. I, therefore, used a combination of purposive and snowball sampling to conduct 39 semi-structured interviews with EV users who live and/or drive in Dublin. I standardized my interview guide depending on the respondent group, but I included space for context-specific questions depending on the role of interviewees. The initial stages of each interview shed light on drivers' agency, while the latter sections attempted to identify how EV users understand and relate to the broader shift towards EVs. The respondents were aged between 30 and 70; 54 per cent were men; and the vast majority were employed in the services sector. Some of the respondents (around 25%) were either core members or otherwise closely affiliated with Ireland’s EV user lobbying group, the Irish Electric Vehicles Owners Association (IEVOA), which was formed in 2015 and aims to be “a community-driven lobby and membership group for EV owners on the island of Ireland” (IEVOA, 2023a). I also conducted 23 interviews with representatives from Irish and international firms operating in and around the EV sector (e.g., automotive dealerships, charge point installation companies); and 10 interviews with respondents from the public sector and regulatory bodies. Finally, my work draws upon analyses of policy and strategy documents published by the state regulator, the Commission for Regulation of Utilities, and the state-owned Electricity Supply Board (ESB), which plays a major role in Dublin’s effort to decarbonize the city.

6.2 Conceptualizing the decarbonizing city

Decarbonisation entails the novel reworking of cities in ways that tend to “work with (rather than against) the grain of existing inequalities” (Bridge, et al., 2013, p. 336). Urban decarbonizing projects are conceptualized as ‘new energy spaces’ (Bridge and Gailing 2020), when they give rise to “novel combinations of energy systems and social relations across space – that is, a process of uneven development – rather than an interest in only certain energy technologies” (p. 1038). New energy spaces can include new infrastructural arrangements such as EV charging stations; new sites of energy production and consumption; new loci of accumulation. They also can relate to what Hodson and Marvin (2010, p. 299) call ‘premium ecological enclaves’, which refers to the emergence of new bounded and divisible geographies in cities that demand “internalized ecological flows that attempt to guarantee strategic protections and further economic reproduction.”

Thus, rather than leading to a 'just transition' (Heffron & McCauley, 2018), there are signs that pathways to decarbonisation will create new injustices, which is not surprising because international efforts since the 1990s to shift towards decarbonisation have by design, "interact[ed] strategically *with* existing social power relations" (Tyfield, 2014, p 601; my emphasis) to maintain the status quo and enable existing constellations of capitalist accumulation to expand (see also: Rudolph, 2022). Crucially, as signposted by Corson, et al. (2013, p. 4; see also: MacDonald, 2013), decarbonizing efforts tend to generate a type of "green grabbing [which] encompasses not only physical land grabs, but also the privatization of rights to nature, the creation of new commodities and markets, green sanctions for otherwise declining forms of capital accumulation, and the disabling of institutions that could pose threats to these processes."

Further concerns about decarbonizing efforts are highlighted by political ecologists and geographers. Low-carbon infrastructures entail a growing dependence on raw materials such as lithium and a surge in interest in creating new mining projects. In northern Portugal, for example, Barrroso agrarian communities are confronted with new mining projects – propped up by European Commission policies – that will "degrade, if not destroy, an area with rich biodiversity, cultural heritage and world-renowned agricultural practices" (Dunlap & Riquito, 2023, p. 18). Further, Bustos-Gallardo, et al. (2021) demonstrate how new demands on lithium production for batteries place social and ecological pressures on areas such as the Andes regions in South America, which produce "ecological contradictions (notably around water depletion) with potential to disrupt accumulation" (p. 177) and create resource conflicts in the region. New questions are also emerging around the limited scale of current supply chains as evidenced by the IEA's (2022b, pp. 49-50) claim that global EV battery demand will require 50 new lithium projects, 60 nickel mines and 17 cobalt developments by 2030. Thus, despite the hype and current 'greenwashing' practices on the part of automobile manufacturers, several scholars have suggested that, in fact, decarbonising automobility is the "hardest case" of sustainability transition (Geels et al, 2013, p. xiii, see also: Tyfield, 2013; Tyfield, 2014). Indeed, as Dunlap

(2020) notes, a fundamental part of the difficulty is precisely that multiple sites along an expanding electricity grid will experience “intensifying socio-ecological harm and degradation via infrastructural colonization” (p.2; see also: Kallianos, et al., 2022). Decarbonizing the global north city can only occur via problematic ecological transformations elsewhere that “might escalate rather than reduce global resource and energy demand” (Henderson, 2020, p. 1993).

Targets that encourage the production and sale of EVs have become a fundamental strategy in the global decarbonising project. For mobility justice scholars (Sheller, 2018; Henderson, 2020), one key reason is that this array of technology reproduces the “system of automobility” (Urry, 2004), which has dominated cities for over a century now. This system relies upon and reproduces the central role of car manufacturing in industrial economies; the place of cars in driving individual consumption, the economic complexes cars underpin (e.g., road-building, urban design, energy production and distribution), the private forms of mobility cars produce, the mobile cultures cars sustain; and the car’s role in environmental resource-use (Urry, 2004, p. 26). Henderson (2020) has argued that efforts to promote EVs are designed to enrol wealthier users who make new claims over urban space designated for green projects in place of infrastructures such as cycleways, bus lanes, and walkable spaces. EV drivers should be viewed as “kinetic elites” (Henderson, 2020, p.1998). Kester (2018), moreover, argues that charging infrastructure merges automobility with electricity systems in new ways, which exert pressure on users, states, and the private sector to deploy security practices to “strategically protect” (as per Hodson and Marvin, 2010, p. 299) and stabilize the continuous circulation of energy and capital oriented around the decarbonizing of transportation. The EV infrastructure in every city constitutes a key part of the ‘new energy spaces’ emerging in the shadow of climate change debates. In short, scholarship on the emergence of EVs provides numerous insights about what matters and what scenarios to expect.

However, what we have not seen enough of in the literature is evidence that this set of developments reflects the peculiar way that processes of capitalist accumulation draw upon and touch down in the city. We know that capitalism's "ability to overcome space is predicated on the production of space" (Harvey, 1985a, p. 149). We also know well that, on the one hand, capitalist accumulation depends upon durable relations in space – or a degree of structured coherence, which Harvey (1985a, p. 146) defines as "regional spaces within which […] supply and demand (for commodities and labour power), production and realization, class struggle and accumulation, culture and lifestyle, hang together" – while, on the other hand, it also needs and produces a vast and proliferating circulation of mobile capital. Because capital is a social relation on the move, it must circulate to deploy surplus capital and labour profitably, hence the creation of new loci of accumulation will threaten "the values already fixed in place elsewhere" (Harvey, 2014, p. 152). The upshot is an "inconstant geography" (Storper & Walker, 1989), which occurs by virtue of new accumulation drives that continuously transform the spaces of production and consumption. In turn, the contradiction between fixity and mobility in capitalism generates a politics of local economic development defined, in central part, by 'local dependence' (Cox and Mair, 1991; 1988), which is a major characteristic of urban life. Capital's inevitable mobility exerts stress on economic agents and compels them to defend their investments, for example, via scalar activity to produce political or economic action. One key outcome, charted extensively by Marxist geographers operating in the context of Fordism's decline, is the formation of cross-class alliances, which can (but do not necessarily need to) take the form of a regional class alliance (Harvey 1985; Smith 1984b). Capitalism creates the conditions for such alliances to emerge because it places pressure on locally dependent economic agents to intervene in to defend the circulation of capital in their locality or region. Workers, unions, business associations, and local government can agree to set aside some differences with a view to acting in concert to fortify the extant structured coherence or at least to strengthen the durability of their economy (Cox & Mair, 1991; 1988; Cox, 2010).

If most of the literature on cross-class alliances has tended to focus on *defensive* regional class alliances, which "have the *sole* function of warding off devaluation and displacing it geographically" (Smith, 1984b, p. 126, my emphasis; see also: Jessop, 2006), my conceptualization of cross-class alliances sheds light on *offensive* projects that aim to create new flows of capital by enacting socio-spatial change in accordance with the demands of capital and emergent but contingently-located allies. Drawing on, and developing, Marxist geography, I propose analysing the role of cross-class alliances in the creation of a decarbonizing city. The inspiration for my work is the contribution of While et al. (2004, 2010), which demonstrates how the urban arena becomes a crucial site in the formation of 'socio-ecological fixes' to capitalism's social and environmental crisis tendencies. Their argument pivots on what they refer to as the 'sustainability fix,' which takes shape when the state responds to environmental pressures by selectively incorporating "ecological goals in [the] greening [of] urban governance [to] balance economic, social and environmental demands" (While, et al., 2004, p. 551). As they suggest, efforts to introduce such a fix emerge because "the geographical reproduction of the capitalist mode of production depends on uniting territorially-based class interests and factions behind a coherent line of action" (While, et al., 2004, p. 551). One result can even be the formation of projects of eco-state restructuring, which can include the establishment of new institutional and governance structures to help manage environment-economy tensions at a range of scales. My argument is that eco-state restructuring provokes the formation of cross-class alliances, which take shape in the context of "the politics of carbon control [which] has emerged alongside, or even replaced altogether, sustainable development as the principal discourse and rationality underpinning new modes of societal regulation" (Jonas et al., 2011, p. 2542). Furthermore, such alliances need to emerge because capital cannot visualize and compute, nor make real, all of the socio-spatial changes required by projects of eco-state restructuring. A case in point here concerns the present-day project of producing and consuming EVs. A crucial consideration is that responses to the climate change question, such as actions intended to decarbonize the city, must occur in the specific context of each locality. In this regard, and from the perspective of the automobile sector, cities must develop a general infrastructure that can facilitate sales of commodities such as EVs; but the specific form of that infrastructure will depend on place-specific conditions because each place has its own historical and geographical dynamic affecting matters such as planning policies, relations between firms and utilities, and so on. What lead automobile firms need is an explicit or implicit alliance with smaller-scale firms providing charging infrastructure and EV drivers who will act as individual, or collective, champions (or evangelists) for the adoption of this new commodity. Moreover, what lead automobile firms need is *local* champions – whether charging point providers or EV owners – who can create or craft the place-specific infrastructure that will facilitate broader uptake and sales of EVs.

6.3 Shaping and contesting eco-state restructuring in Dublin

Dublin, like any city, is full of paradoxes. It has Europe's eighth-highest GDP by metropolitan region (Eurostat, 2019); is the fourth most attractive city for European investment (Ernst & Young, 2022); and the most popular European headquarters location for foreign investors (Shehadi, 2020). At the same time, socio-spatial inequalities mark the city. There is a significant housing and homelessness crisis (Lima, et al., 2022; Hearne, 2014). Some areas such as Clondalkin or Ballymun rank highly on national indices of deprivation (Teljeur, et al., 2016). In addition, the city is host to a spate of state-led neoliberal policy experimentation (Lawton & Punch, 2014; Fraser, et al., 2013; Punch, 2005), which on the one hand, markets Dublin as a 'European city' and orients the city "towards the assumed tastes and desires of the emergent urban professional classes" (Lawton & Punch, 2014, p. 865). And on the other, the state's urban renewal and restructuring programs have created deepening crises for working-class communities "in the shape of gentrification pressures, as well as… [in] the poverty of everyday life" (Punch, 2005, p. 769). The project of decarbonizing the city therefore unfolds in a complex context.

With respect to Ireland's growing use of EVs, government policy has played a major role. In 2010, for example, the Irish government and ESB, the state-owned electricity firm, signed a Memorandum of Understanding with Nissan and Mitsubishi to create the EV sector in Ireland from scratch. As part of this broader strategy, a state regulator, the Commission for Regulation of Utilities (CRU), required that the ESB create Ireland's first EV charging network. This experiment, known as ‘the EV pilot project,’ aimed to provide national scale coverage to test the impact of EVs on the electricity distribution system. It used low-voltage recharging points used by first-generation EVs. The infrastructure was free-to-use as part of the state’s effort to encourage EV adoption. In 2019, a CRU decision paper gave ESB permission to commercialize the asset under a separate business entity, ecars, and introduce new pricing mechanisms. By this time, the EV sector had expanded, leading the government's climate action plan to set a target of 845,000 EVs on the road by 2030.

Government policy boosted the expansion of EVs by providing €322.47 million in subsidies (PBO, 2022) to buyers under an electric vehicle grant scheme and an electric vehicle home charger grant scheme, as well as Vehicle Registration Tax relief for EV buyers. As with all subsidies, controversy has followed, although the case of EV subsidies is illuminating because EV buyers tend to be among Irish society’s wealthiest members. As illustrated by Caulfield (2022), EV home charging infrastructures are situated primarily in wealthier neighbourhoods. Indeed, Jennifer Whitmore, a TD (Member of the Irish Parliament), described the subsidies as “a major transfer of wealth to those who do not need it (Drennan, 2022).” Moreover, as shown in Table 6.1, 79% of grants were awarded to EV purchases costing more than €40,000. The average annual earnings for full-time employees in 2019 in Ireland is €48,946 (CSO, 2020).

Table 6.1 EV grants awarded in Ireland from 2012-2022.

Price of vehicle (€)	**Number of grants paid from 2012-2022**	**Total grant value (€)**
€0-30,000	525 (1%)	€2,262,600.00
€30,001-40,000	7,861 (20%)	€36,978,500.00
€40,001-50,000	14,502 (38%)	€68,954,200.00
€50,001-60,000	10,452 (28%)	€50,246,300.00
Over €60,000	5,017 (13%)	€23,904,200.00
Total	38, 357	€182,345,800.00

Source: Obtained through a data request from the Sustainable Energy Authority of Ireland (SEAI) under the reuse of Public Sector Information (PSI) regulations.

For champions of the EV sector, then, the last decade has been marked by steady growth and greater awareness of the role EVs could play in a broader effort to decarbonise Dublin and Ireland's transportation sector. But the shift toward EVs has produced new complexities; a new geography, a new infrastructure, and a new approach to mobility is required. For example, consider that, when the Irish government began to promote EVs in 2010, only two EV models were available to purchase; by 2016, there were six models; in 2022, there are at least 60 models available. The market *has* expanded; however, the infrastructure EV drivers require has not developed in a coordinated manner. This is not a feature in Ireland alone. One part of the issue here is that the EV sector has emerged in the context of struggles among automobile manufacturers and regulators to define how charging should occur. There are numerous standards and specifications. Individual corporations such as Tesla, alliances of Japanese firms, and regulators in the European Union have pursued their own standards. Re-fuelling an EV requires the use of a charging cable and a charging unit (at home, at work, or in public space). One of the first EV models sold in Ireland, the Renault Zoe, re-charged using an AC (Alternating Current) connector. Since then, most cars are re-charged using one of two broad DC (Direct Current) standards: CHAdeMO (a standard developed by an alliance of Japanese manufacturers) or CCS (Combined Charged System, which the EU has promoted). The upshot of all this in Ireland is that EV drivers have had to negotiate a confusing, complex, and uneven charging infrastructure at home and away from home.

Another element at issue here is that the emerging geography, the map, of Ireland's EV infrastructure (again, at home and away from home) is not the product of a coordinated effort on the part of the state or capital. As I have noted, the Irish state did try to promote EVs; it did form partnerships and alliances, for example with Nissan and Mitsubishi; and through its ownership of ESB, the state has played a key role in establishing many of the earliest charging points. However, its efforts overall still have not been directed at coordinating things to any great extent, which reflects the general neoliberal stance of Irish policymakers (Fraser, et al., 2013). In effect, the approach has been to encourage firms to research and develop a charging infrastructure. It has fallen on Irish-owned firms such as EasyGo, international firms such as Ionity (a joint venture between BMW, Mercedes Benz, Ford, Volkswagen, and Hyundai), and Tesla to create the map of EV chargers. Capital, not the state, makes the EV charging map. This lack of coordination – the absence of a state-led plan for how EV drivers will charge their vehicles and the reliance on firms to create the map of charging points – burdens EV drivers at the frontlines of the infrastructural shift in Dublin's transportation sector. My research has sought to understand what EV drivers make of this environment *and* what they do about it. I have three points to make.

6.3.1 The burdens and technicalities of Dublin's inadequate EV infrastructure

In this sub-section, I shed light on the burdens drivers experience as they encounter an inadequate infrastructure. One key consideration relates to the inconstant nature of infrastructural arrangements driven by shifts in EV charging standards and specifications that appear against a backdrop of coercive laws of competition that compel charge point operators (CPO) and automobile firms to innovate. Yet, also at issue are the burdens that emerge from the lack of coordination at the planning and policy level, which produces an incongruous geography that EV drivers negotiate and overcome through a range of creative and strategic actions. With regards to the different charging options, respondents in my research demonstrated significant awareness of the technicalities of operating an EV. If they owned a Nissan Leaf, for example, they could only use a DC (direct current) fast charger in a public charging point if the charging unit was not already charging a CCS vehicle, such as a Hyundai. Consider Respondent 4:

> "…if I pull up to a fast charger, the way they're configured at the moment, and if somebody is charging a Hyundai on CCS, I cannot charge up at the same time [because my car is charged using] CHAdeMO. So even though the fast charger has, like, three different plugs, and can charge two cars at a time, [it] can't charge CCS and CHAdeMO at the same time." (Respondent 4, EV user)

For this respondent, then, everyday experience of using an EV is characterised by an ongoing battle to draw effectively upon the infrastructure. The result is a sense of frustration:

> "…it's a bit stupid, I pull up and there's a [CCS-charged] Hyundai there and I can't charge [my CHAdeMO-charged car] until [the Hyundai is] finished even though he's using a different connector. That's a bit frustrating." (Respondent 4, EV user)

Complications associated with using a CHAdeMO vehicle are reduced by purchasing a car using CCS. Respondent 21, for example, discussed the potential benefits of her Kia Soul, which is charged using CCS, over her previous vehicle, a Nissan Leaf, which used CHAdeMO:

> "I want to be able to look at my app and say "right, which [charging point] is cheapest at the moment?" and say, "that's grand, I'm going to charge there." I know I couldn't [doing this] with the [Nissan] Leaf, because the charge is a different charge port, it's a CHAdeMO, whereas now with the CCS [which charges her Kia Soul] I have more options now with it." (Respondent 21, EV user)

The inadequacy of the infrastructure is drawn upon and negotiated by EV drivers. In some cases, as per Respondent 21 above, drivers look to upgrade their vehicles. In other cases, EV drivers learn to adjust to the circumstances. As Respondent 30 highlighted:

> "… you're unsure of chargers and stuff because there's different [options such as] CHAdeMO and there's the CCS and you kind of go "God, can my [car] take that?" And you're not quite sure […] So there is that level of anxiety. But once you're used to it, you don't even think about that anymore. You just you know how it works. You just get on with it, you know?" (Respondent 30, EV user)

If struggles among automobile manufacturers and regulators to define how charging should occur produce circumstances in which EV drivers in Dublin experience frustration and anxiety, using EVs also entails ongoing negotiations with the unplanned geography of charging locations. There will be logic to the locational decisions of firms such as EasyGo or Ionity; but none of the respondents in my research were satisfied. Indeed, for Respondent 2, the map of chargers was inexplicable:

> "I don't even know how they decided what places to put the chargers, it feels like a completely random decision. Like someone had a few marbles they threw them in the air, they landed on the map, put a mark there let's do this. There's no sense to it at all." (Respondent 2, EV user)

The infrastructure was criticized. Some retail parks, such as Liffey Valley, had not installed chargers; other places, however, had done so and some of them proved to be popular with EV drivers:

> "There is a faster charger at the N7 here at Newlands Cross. It's a beautiful location. It's at a Topaz service station; and everyone who charges there always go to Topaz, gets a coffee, gets something else…" (Respondent 2, EV user).

In the process of negotiating the infrastructure, then, EV drivers learn about the charging map and develop mechanisms to handle things. Respondent 8, for example, discussed how he adapted his driving practices to take account of the uneven map of charging locations and what they offered:

> "I'd phone up one place and they had said, "Yes, we do have chargers." […] But it was very low power chargers. So, I knew that […] I'd only be getting a trickle, while I was there, so I needed to plan [to charge the car more] afterwards. But once you get there, and you discover that, then you can plan for any future visits." (Respondent 8, EV user)

For Respondent 27, adaptation was also about anticipating difficulties when charging. He noted that, when planning a trip, it would be a matter of hoping that,

> "…there isn't [sic] too many people in front of you. And it's that planning of, okay, what to charge in A. location but leaving enough in the battery that if A. location is either faulty, out of service, or is already, somebody's already charged at it, I can go to B. location down the road. And I still have enough charge. So, you're not leaving it to the 1% left in the battery." (Respondent 27, EV user)

The evidence regarding EV drivers and their experience of the infrastructure affecting their lives demonstrates that driving an EV involves an ongoing engagement with an odd, uneven, and at times inadequate geography that fails to do enough if the Irish state's goal is to decarbonise this component of the transportation sector. From the perspective of capital, meanwhile, the complications charted above are barriers in the way of creating the conditions for accumulation in this area of the automobile sector. In short, the infrastructure must improve. In the interim, what's so striking about the Dublin case, as I now discuss, is the way EV drivers pursue actions that compensate for the inadequate infrastructure.

6.3.2 Fixing the (cultural) infrastructure

I argue in this sub-section of the paper that EV drivers develop, and encourage the adoption of, new practices to share the inadequate infrastructure they encounter. Whether through individual actions and conversations with other EV drivers, or via formal efforts channelled through the Irish Electric Vehicles Owners Association (IEVOA), respondents in my research emphasized the centrality of developing a culture around EV use. Given what they encounter on a daily basis – given the burdens and inconveniences associated with using an EV; given the perceived 'special' position of EV drivers within the wider transportation landscape – EV drivers call for the expansion, and even the governance, of what they refer to as 'EV charging etiquette.'

The core challenge, as I noted in the previous sub-section, is that EV drivers often struggle to find charging points they can use, when they need to use them. One risk is that, upon arriving at a location, they find there is "always someone plugged into" (Respondent 2) it. Another is that…

> "Sometimes you'd pull up beside a charger and somebody is on it, and they will completely ignore you. They will stare at their phone. And you only want to know how much longer are they going to be. But that's very rare." (Respondent 4, EV user)

'Good' etiquette can ameliorate the problem. Consider Respondent 4:

> "…recently, I was coming home from Dundalk and I was at a local charger and as I came around I thought there was a car there, which

> happens so rarely and I was like “oh no, I am going to have to wait, like, 20 to 25 minutes to get on the charger” and the guy was walking away from the car and, very nicely, he came back over to me and said “I’m only going to be 10 minutes.” I’m like, “that’s perfect” […] That wouldn’t be uncommon, a lot of that kind of camaraderie; and as I say, I think it’s because people feel we’re pioneers and we’re kind of in a club” (Respondent 4, EV user)

Thus, an overriding element in the etiquette is politeness. It’s about respect, decency; about encouraging drivers to share the network in a peaceful manner.

‘Good’ etiquette is also about caring for the infrastructure. Given the purported ‘pioneering’ spirit of EV driving, a culture is needed that encourages sharing of a limited, but special, resource; it is about promoting a sense that, because the specific commodity they use is supposed to “nicer for the environment” (Respondent 1), they should be active and monitor the status of the infrastructure. In this case, ‘good’ etiquette involves interacting with the infrastructure and reporting technical faults or other problematic features. Consider:

> “I have rung [a charge point operator] maybe twice as a gripe to say, ‘there is people blocking it’ [and] you can see on the app very clearly when they started charging […] you really got to work together, or it doesn't work.” (Respondent 39, EV user)

Others highlighted the existence of charge points where “No one was taking care of it, so it was constantly broken, vandalized basically” (Respondent 2). Perseverance is required, however, because one aspect of the infrastructure’s inadequacy is the limited capacity of firms to understand the technicalities. For example, as noted by Respondent 2:

> “You can see [evidence of the insufficient maintenance of EV charging infrastructure] when you call the helpline. There are a good

> few [who answer calls on the helpline] who are really into it, and they understand and try to help you. But if you get the wrong guy [when reporting a problem], the reaction is “I’m going to send a technician there and mark [the charge point] as unusable.” But [I reply] “I need it now; I need it today. Just restart the bloody thing. […] I did it like 50 times now on this very unit so, I know much more about it than you do, even though you work for them, not me” [Calling the helpline] doesn't help; it actually makes it worse. Then you call back and you get another chap and suddenly, “yeah sure boom.” No consistency, no proper customer service…” (Respondent 2, EV user)

If part of the cultural question involves engendering among EV drivers a sense of solidarity, politeness, and care; another component is the constant challenge of engaging non-EV drivers. Although EV charge points are usually marked out with signs and coloured paint, EV drivers often find that non-EV cars are parked there and block access to the charger. Known as ‘ICE’ing’ (because of the ICE acronym for internal combustion engine), this practice is despised by EV drivers. IEVOA have advice about what EV drivers should do when they encounter ICE’ing:

> “If a petrol / diesel car is parked at a charger, leave a message but not a nasty one! Assume ICEing is as a result of a lack of awareness, not ignorance. Not everyone knows what those blue boxes do, and signage tends to be inadequate at chargers” (IEVOA, 2023b)

Arriving at a charge point to find the space has been ‘ICE’d’ generates significant tension:

> “…it does frustrate me when you see, like, a normal car parked in an EV space and particularly in shopping centres that they just think, you know, “that space will do.” Even though [the parking space has been painted] bright green, it's EV only, and they still park their bloody BMW 5 Series in there. Although other people do actually go to town

> and actually report them, put stickers in the windows and stuff, and I get why they do it […] I've actually left my car behind them, so they can't get out […] you want to encourage, you want to do everything you can, to encourage people to move to electric cars. And by people abusing it, and not treating it right, someone will probably go "well, I'm going with this [non-EV car] because it's out of control. You know, I'll never be able to charge the damn thing and stuff like that." I mean, clearly, we're going to go that way, it's all going to be EVs eventually." (Respondent 39, EV user)

From the perspective of capital again, actions on the part of EV drivers to engender a new culture of EV use – a culture which also engages non-EV drivers, partly for the sake of encouraging 'people to move to electric cars' – help to create the conditions for accumulation to expand in this area of the automobile sector. A cultural infrastructure is required on top of improvements in the physical infrastructure. What's so striking about the Dublin case, then, is the way EV drivers implicitly work for, and ally themselves with, capital. They negotiate an infrastructure-in-the-making – an infrastructure that produces burdens and inconveniences that betray the representations of EV driving – and respond to it by trying to create a different (cultural) geography of the city; a cultural geography that celebrates the EV commodity and rubber-stamps the 'green' credentials of firms such as Volkswagen and Nissan. As I now move on to discuss, further evidence of this implicit alliance with capital can be found in attempts by EV drivers to intervene in debates and policy development regarding the charging infrastructure on which they rely.

6.3.3 Fixing the infrastructure, politically

If the evidence above suggests an implicit cross-class alliance between EV drivers and automobile capital, the evidence I use in this part of the paper suggests the existence of a more explicit alliance. The core issue concerns the Irish Electric Vehicles Owners Association (IEVOA). In addition to offering advice to EV drivers and encouraging 'good' etiquette, IEVOA also has a lobbying arm which tries "to support and represent the needs of electric vehicle owners [by] liaising with government departments, local authorities, public charging network operators and other stakeholders to ensure that the necessary policy, incentives, and infrastructure is being put in place to support the ambitions for electric vehicle adoption laid out in the Climate Action Plan" (IPRA, 2021). IEVOA is not shy in mentioning its close links with capital. As Respondent 1 noted, for example, IEVOA has a close relationship with Nissan:

> "Nissan have been a really big advocate of electric vehicles in Ireland very early on. This is why I think for the last, well maybe not the last couple of years, but, the previous years they had something like 90% market share. Simply because they put the marketing money there. Their cars were affordable; they were supporting it and educating the salesforce, etc. They've been really good with it. They've been really good to [IEVOA]. For example, every year they've offered to host [IEVOA's] AGM. I mean not this year because we couldn't have anything physical [due to COVID-19 public health restrictions] but all the previous years, we had it on their premises. And actually putting up money and supporting us in that way as well. So, they are really supporting that." (Respondent 1, EV user)

If evidence of a more explicit cross-class alliance between EV drivers and automobile capital is suggested by the close relationship between IEVOA and Nissan, further evidence emerges when IEVOA's lobbying, or policy-shaping activities are examined. Connecting with While, et al.'s (2010) focus on 'eco-state restructuring', I argue that capitalism in Ireland necessarily requires state intervention, such that any 'ecological' shift in Ireland's variety of capitalism also involves restructuring, or at least a "reorganisation of state powers, capacities, regulations and territorial structures around institutional pathways and strategic projects, which are […] viewed as less environmentally damaging than previous trajectories" (While, et al., 2010, p. 80). In this context, it is significant that IEVOA has called for a broad-based reorganisation of state powers to encourage car drivers to adopt EVs, especially by developing the EV charging infrastructure. It has worked for capital by lobbying as a local organic association of EV drivers. It has tried to push the state to effectively expand the necessary infrastructure. Consider two points here.

First, one component of IEVOA's activities has been concerned with the decision (which I noted briefly at the outset of this section) in 2019 by the CRU to allow ESB, a semi-state utility company, to commercialize the public charging network and introduce pricing for what had been a free-to-use infrastructure. The state's shift away from providing a free-to-use infrastructure was a significant restructuring project. It was controversial. For Respondent 36, then:

> "I don't think the ESB have done a good job… I think they held back on repairing a whole load of chargers while they were waiting for the government to give them funding. They let all chargers fail and did not respond to requests for repairs. Then suddenly, they could afford all these new ones." (Respondent 36, EV user)

In evidence provided in 2017 to the Joint Committee on Communications, Climate Action and Environment, IEVOA secretary, Dave McCabe, argued that the public charging network should have been viewed "as a strategic asset in the adoption of electric vehicles and not simply a method of creating another fuelling network" (Oireacthas, 2017). IEVOA did "not approve of the unregulated transfer of the public charging network to the ESB," although it acknowledged that "there is a place for the commercialisation of public chargers. No driver expects to get his or her electricity for nothing" (Oireacthas, 2017). In its 2017 submission to a public consultation regarding the ESB's electric vehicle pilot project, IEVOA also stated that "Premature commercialisation would seriously affect new EV take-up [because] many EVs are acquired because of perceived low running costs and the assistance at present, of free charging, is a clear incentive" (IEVOA, 2016). As such, market instruments were not to be eschewed; rather, what IEVOA wanted was for the state to move slowly. What we can detect from IEVOA's interventions, then, is the group's anxiety over expanding the infrastructure: investments now might prove to be disastrous, hence the need for caution. Their objective was the same as capital's: expand the infrastructure and lay the foundations for further sales. Their local knowledge was mobilized to encourage what they hoped would be effective eco-state restructuring.

A second component of IEVOA's activities has focused on encouraging other forms of eco-state restructuring. For example, in a 2015 statement to the Joint Committee on Transport and Communications, the IEVOA called for a package of incentives to encourage EV sales, such as: allowing "electric vehicles free access to bus lanes;" grants "towards the purchase and installation of an electric vehicle charger;" changes to the tax code so EV users would "have free road tax when they purchase an electric car and zero emissions should lead to zero tax;" and amendments to building regulations "for new homes to facilitate the installation of a 7 kW charge point in the initial build" (Oireachtas , 2015). As such, for IEVOA, a wide range of the state's national and more local powers should have been restructured to encourage EV uptake.[3] What they have managed to do is draw upon their knowledge of the unplanned, chaotic, anxiety-inducing infrastructure they experience on a daily basis to demand a different geography is produced. They contest Ireland's eco-state restructuring. To the extent there is a "sustainability fix" (While, et al., 2004) that promotes decarbonization in Dublin and Ireland more generally, IEVOA stands out as key intermediary and protagonist that tries to adjust the form and character of the fix in a way that will yield growth in the sales of EVs. Crucially, the fix should also be market-oriented: it is about encouraging tax breaks, financial incentives, and other special benefits for EV users.[4] It is also about selective state support for EV users, for example with

[3] This sort of argument arose in my interviews. For example, Respondent 15 noted: "I don't understand if the government has the power to legislate how you are allowed to sell a polluting fossil fuel without providing an electric charger, and that for me is the most obvious thing… if you have a forecourt, you have to have at least one electric charger to be allowed sell fossil fuels." In short, the call here is to use the market to discipline firms to change their approach to EV users; to use the market as an instrument to enact change. In other words, eco-state restructuring should be market oriented.

[4] It is a perspective that takes shape in the context of awareness that, even when the local state has funds to expand the infrastructure, it sometimes fails to do so. As an example, a recent report has

regards to the use of the state's powers to alter building regulations. In short, IEVOA has pursued infrastructural and policy change intended to benefit EV drivers *and* capital. Volkswagen and Nissan could invest in Ireland (and everywhere else) to change or advocate for changing urban geographies to promote EV uptake; they do not, however, in part because they can be allied with, and provide support to, organic local associations of EV drivers.

6.4 Conclusion

Like many other cities, socio-spatial restructuring in Dublin today is wrapped up with the expansion of 'decarbonizing' technologies, with impacts on energy, housing, and transportation. A 'decarbonizing city' – with close links to capitalism's purported 'greening' – is taking shape in Dublin. This paper focused on the emergence of a new geography in Dublin oriented around facilitating the sale and use of electric vehicles (EVs). Drawing on Marxist literature on the politics of local economic development and efforts to produce 'socio-ecological fixes' to capitalism's social and environmental crisis tendencies, I argued that the emergence of EVs in Dublin requires the formation of a new infrastructure, which capitalist enterprises – corporations such as Volkswagen or Nissan – need but cannot produce. I therefore argued that automobile firms need to be understood as working with, drawing upon, and exploiting an implicit but effective alliance with EV drivers to fix inadequate infrastructures and thereby restructure transport systems across cities like Dublin. The challenge is to create a class project capable of rolling out new physical infrastructures, such as charging points, while establishing unique socio-cultural and institutional mixes, for example regarding the etiquette of owning and using these commodities. Volkswagen or Nissan are ambivalent about how the infrastructure is created in Dublin, Oslo, or any other city. But they are dependent upon locality-specific actions occurring. In Dublin what they can find is a range of novel efforts on the part of EV drivers to engender

revealed that grants available to local councils, which were expected to deliver 200 public recharging points per annum, had delivered only 33 between 2019 and 2022 (Dwyer, 2022). A market-oriented stance tends to ally with such criticisms and failures.

and expand a culture of ‘good’ etiquette. They also find EV drivers investing time and energy to lobby the state with a view to creating a specific form of eco-state restructuring. The picture that emerges is a type of market-oriented class project intended to benefit users of electric vehicles, while also inadvertently facilitating a speed up in the circulation of capital which benefits the automobile sector; the picture that emerges is a type of cross-class alliance between capital and EV drivers that pursues eco-state restructuring in Dublin’s specific context. From the perspective of capital, a general infrastructure that can facilitate sales of EVs is required everywhere; but the shape and form of that infrastructure will depend on place-specific conditions. Automobile firms need alliances with EV drivers.

To conclude, I argue that one aspect of the hype around EVs today is not so much that they should be viewed as part of a ‘greenwashing’ campaign, although that is certainly a key element; rather, the turn to EVs encourages the mistaken belief that capital will manage to fix the climate problem. The portrayal of EVs as futuristic, innovative, and environmentally friendly is bound up with a narrative that, in fact, capital can and will lead the way toward a full and effective ‘sustainability fix.’ In Dublin, the only material benefit of EVs – that they have no tailpipe emissions of pollutants such as Nitrogen Oxides (NOx) and might therefore have less impact on the health of urban working-class communities living close to the city’s main roads[5] – is drowned out by the constant drumbeat of calls for the EV charging infrastructure to improve, which stems from the unplanned and chaotic emergence of capitalism’s turn toward these commodities. Other calls for improved public transport or radical investment in cycling infrastructure also struggle to be heard against the noise of EV champions and evangelists who continue to promote this problematic “system of automobility” (Urry, 2004). As Henderson (2020 p.2005) has noted, although “there is widespread political support to decarbonize away from fossil fuels and reduce transport emissions […] EVs appear to be the wrong

[5] In countries such as Ireland, air pollution from the diesel engine fleet alone is projected to cost 6234 disability-adjusted life years (DALYs) and €663.1 million from 2015-2024 (Dey, et al., 2018, pp. 163-164).

way to do it.” My analysis of Dublin’s shift toward EVs supports Henderson’s argument.

Chapter 7: Glitchy urbanism and the generative digital geographies of Dublin's turn to EVs

7.1 Introduction

In the previous chapter, I drew upon a recent publication, which developed a Marxian approach to examine the fourth core finding: the 'imaginative and iterative' responses of EV users. I shed light on the ways in which automobile and charge point operation firms forge novel cross class alliances with EV users to drive Dublin's shift to EVs. I highlighted how the actions of and relations between EV users help to anchor the decarbonizing process by allowing individuals to navigate and shape an inadequate infrastructure in Dublin.

In this chapter, I draw from critical approaches in digital geography to examine the unique digital characteristics of Dublin's turn to EVs and how these traits intimately shape the experiences of EV users. The emergence of ubiquitous and pervasive digital networks, data, and connected technologies in cities has led many urban theorists to identify the rise of computational cities, with impactful related conceptualizations referring to "smart cities" (Shelton, et al., 2015), "programmable cities" (Kitchin, 2011) and even "eco-cities" (Cugurullo, 2018). Couched in a language of techno-solutionism (Morozov, 2013), computational city imaginaries have largely coalesced around digitalisation models that inform urban governance decisions by drawing upon the data produced from the everyday activity of connected individuals, objects, and spaces. Since the emergence of smartphones, cities have experienced a rapid expansion of digital platform enterprises such as Uber, Airbnb, and Amazon under what some scholars refer to as 'platform capitalism' (Srnicek, 2017) or 'the uberization of everything' (Barns, 2020). Digital platforms produce network effects through a walled-garden architecture that locks in users and extracts data about their activities, which becomes "the raw material" (Srnicek; 2017, p.40) behind the accumulation strategies of platform enterprises. In short, digital platforms allow technology firms to leverage a techno-capitalist vision of a data-driven and mediated city.

Reacting to these developments, urban scholars connecting with literature on digital geographies have turned their attention to 'platform urbanism' (Leszczynski, 2020; Graham, 2020; Barns, 2019). Platform urbanism refers to "urbanisation that is deeply shaped by the conditions and affordances of platforms" (Barns, 2019, p. 4) and demands a form of research that can apprehend the chaotic unfolding of platforms across cities. Platform urbanism is characterised by multiplicity, heterogeneity and contingency, emerging, for example, within 'platform work' in the service economy (Graham, et al., 2020; Ecker & Strüver, 2022), the creation of platform infrastructures that hinge on smartphone apps for real-time exchange (Dammann, et al., 2022), or the promotion of new urban governance strategies aimed at shifting public services and information to platforms (Schou & Hjelholt, 2019). The focus here is on capturing "the specificities of platform materialities *beyond* smart city formations" (Leszczynski, 2019, p. 190; my emphasis). In some contribution, platform-mediated cities are seen as beholden to the accumulation strategies deployed by the largest platform enterprises (see: Rodgers & Moore, 2018; Sadowski & Gregory, 2017). Seen in this light, platforms appear as omnipotent configurations intended to remake "cities in their own image on a planetary scale" (Leszczynski, 2020, p. 195).

A sharper conceptualization of platform urbanism notes the predisposition of digital systems to error (failure, dysfunction) and erratum (correction, fix) in ways that "appear not to reconcile with theoretical metanarratives or conditioned expectations of digitally mediated [urbanism]" (Leszczynski & Elwood, 2022, p. 362). In response, a conceptual innovation is to focus on the notion of 'the glitch' (Leszczynski, 2020; Leszczynski & Elwood, 2022; Russell, 2020). Attention to the glitch emerges from counter-topographical conceptualizations that "do not deny power of capitalist social relations […] or the theories that explain them – but which reveals their limits in ways that suggest new means to undo them" (Katz, 2017, p.599). According to Sundén (2015), the glitch has relevance today because digital technologies hold "accidental potential […] always implicating their own failures and breakdowns." Glitches need to be understood as "systemic nonexceptions within urban technocapital" (Leszczynski & Elwood, 2022, p. 365) that open space for negotiation and contestation when users encounter small-scale disorientations such as "the pixelated hiccup, the frozen screen, or the buffering signal" (Russell, 2013, n.p). The negotiation and contestation of glitches can act "as a fissure" (Russell, 2013, n.p), as something potentially generative, as a moment (or space) when (or from which) transformation can occur.

Against this backdrop, I focus on the glitchy platform urbanism behind sustainability transitions. In many cities across the world, decarbonisation and digitalisation coalesce in low-carbon platforms: new software and applications that enable individuals to connect, communicate and exchange with an array of decarbonising technologies such as smart energy meters, residential solar panels, and electric vehicle (EV) charge points. My specific focus is on the shift toward electric vehicles (EVs) in Dublin's transportation sector. The Irish government has set a target of 845,000 passenger EVs on the road by 2030 (Department of the Environment, Climate and Communications, 2021, p. 193), which the Society for the Irish Automotive Industry (SIMI) suggests would require 100,000 fast-charging points compared to the figure of 2,500 public charge points available today (Arup & Jim Power Economics, 2022). In turn, efforts to expand the public charging network have brought attention to various faults and inadequacies across and within the charging network. I conceptualize these faults as glitches within an emerging platform urbanism and examine how they exert pressure on actors involved in the shift to EVs. I ask: how do glitches prompt EV drivers and the wider industry to pivot, circumvent, or find fixes and thereby reconfigure the city's decarbonising process?

I organize the rest of the chapter as follows. In Section 8.2, I begin by elaborating on the theoretical backdrop of this chapter. I focus on the 'buggy and brittle' and 'glitchy' frontiers of platform urbanism before bringing the notion of 'the glitch' into conversation with literature on decarbonisation. In Section 8.3, outlines my analysis of glitches in Dublin's transition to electric vehicles (EVs). I pay particular attention to the ways in which platform glitches provoke a range of reactions on the part of the public and private sector actors who attempt to 'scale' their way out of the trouble. In turn, I demonstrate how the process of 'fixing' the glitch falls upon EV users who pursue a range of digitally enabled actions to circumvent and overcome the faults they encounter. In Section 8.4, I draw some concluding remarks and suggest avenues for future research in digital geography and beyond.

2. Glitchy platform urbanism and decarbonisation

2.1 The glitchy motors of platform urbanism

Whether veiled in a language of sustainability, growth, or connectivity, digital platforms have been central to "[r]casting all complex social situations either as neatly defined problems with definite, computable solutions or as transparent and self-evident processes that can be easily optimized" (Morozov, 2013, p. 5). National and subnational governments are grounding digitalisation objectives through platforms (Schou & Hjelholt, 2019), platform enterprises are harvesting data to inform so-called 'smart' urban governance, and platform-enabled data monetisation strategies are constitutive of a new 'digital growth machine' (Rosen & León, 2022) that states leverage under incessant commitments to 'growth first' approaches to urban development. Like technocratic visions of the smart city before it, the platform-mediated city has privileged digital systems as 'common sense' and pragmatic solutions to urban problems without unpacking or bringing to task the power relations that shape and drive urban change. As Fields et al. (2020, p. 462) suggest, the platform-mediated city, "[r]ather than a break with the smart city […] coexists with smart urbanism and modulates its "constituent practices, processes, and technologies" (citing: Leszczynski, 2020, p. 5; Sadowski, 2020).

Much of the hype surrounding digital platforms relates to their real-time applications and network effects, which digital geographic scholarship (Barns, 2019; Sadowski, 2020) argues, tend to make cities seem more accelerated and compressed. Platforms alter the spatio-temporal dynamics of cities by digitally transducing and mediating space in ways that enhance forms of connectivity. Platforms are characterized by "geographical and temporal flexibility and fluidity" (Caprotti, et al., 2022, p. 3). Yet, 'intelligence' of platforms hinges on a ubiquitous, pervasive, and functioning digital architecture "that enable two or more groups [-] customers, advertisers, service providers, producers, suppliers, and even physical objects [-] to interact" (Srnicek, 2017, p. 31). Practices that elude the platform architectures, individuals who fail or struggle to use platforms as designed, or objects that break or appear faulty produce barriers in the way of platforms. The caveat is that, as platforms become bound up with core governance objectives, their vulnerabilities, insecurities, and porosity may transform (or undermine) urban development in unexpected ways.

The field of platform urbanism has emerged to examine some of the chaotic and unexpected ways digital platforms come to ground in cities. Moving beyond an analysis of the 'intended use' or 'strategic deployment' of platform technologies, the notion of platform urbanism refers to "a mode of production of space in which platforms are central in the dynamic formation of socio-technical relations between urban space and people" (Ecker & Strüver, 2022. p.3). In this regard, van Doorn, et al. (2021) advance the notion of 'actually existing platformization' to foreground the ways in which user experience is shaped by "protocols, interfaces, and business interests. Yet […] are, in turn, sensitive to local norms, stakeholder objectives, and policy frameworks" (p, 717). Seen in this light, platform urbanism must be understood as a space-making process shaped, of course, by contexts. A focus on 'actually existing' platformization shines a light on the collision of plans and deliberate representations of platforms with local contexts (e.g., cultures, struggles, regulations), thereby producing place-specific configurations.

In this chapter, I draw from recent scholarship in digital geography on the notion of 'the glitch' (see: Leszczynski and Elwood, 2022; Leszczynski, 2020) to examine processes of actually existing platformization. Kitchin (2014, p. 11) notes that "software is an unusual product because it is sold in full knowledge that it is inherently partial, provisional, porous and open to failure." The notion of the glitch directs attention to how this (openness to) failure shapes the operations of digital systems. Like scholarship on the 'buggy and brittle' smart city (see: Townsend, 2013; Kitchin & Dodge, 2011) before it, the glitch provides a useful counterfactual to more solutionist visions of platform-mediated cities. Glitches open digital systems to negotiation and contestation. According to Leszczynski (2020, p. 191) digital systems always hold the "simultaneous potential for both error (malfunction, failure) and erratum (correction to a system)." Therefore, the inner workings of digital systems are never fully set, and glitches leave open them up to negotiation, reconfiguration, and diffraction.

Within these openings, Leszczynski (2020, p. 201) argues that glitches "create opportunities for mundane digital tactics to negotiate, divert, diffract, or differently assemble the platform/urban interface in ways that are *counter-hegemonic…*" (*my emphasis)*. The glitch can generate a moment (or space) when (or from which) technology users can pursue a range of counter strategies to rework, obfuscate, and resist digital acceleration and surveillance. Indeed, this sort of conceptualisation connects with wider scholarship in digital humanities, such as Cheney-Lippold's (2019) notion of 'the else', which draws attention to 'slippages' and 'subjective surpluses' that escape the programmability of platforms and offers a possibility for "deviance, mobility, and ultimately unincorporability according to the conceptual space between algorithms and us" (p. 157).

At the same time, scholarship on the glitch has extended its conceptual moorings to shine a light on "(socio) materialities, aesthetics, and practices that elude the programmability of computational city paradigms" (Leszcynksi and Elwood, 2022). In other words, the glitch directs attention to the ways digital systems are both predisposed to bugs, breakdowns, and failures and, concurrently, how sets of social relations elude or obfuscate transduction, modification or monitoring by software/code. A helpful prompt here is to think through Graham's (2020) notion of 'conjunctural geographies', in which he argues that the power of digital platforms emerges, in part, because they are "simultaneously embedded and disembedded from the space-times they mediate" (p. 453). Building on this idea, I argue that, because space is "the dimension of multiple trajectories" (Massey, 2005, p.24), the disembeddedness of platforms is always at interplay with sets of socio-spatial relations that are elusive and glitchy. In other words, platforms can produce representations of space, and even transduce space, but cannot fully capture the chaotic unfolding of space-in-the-making. A result is that glitchy platform urbanism exerts pressure on, and requires that, users pivot, circumvent, and try to fix the glitches they encounter. The glitch enrols users as neoliberal subjects who should take responsibility for problems, work to find solutions, and reconfigure the city but within the parameters set by platform enterprises.

7.2 Glitchy platform urbanism in the decarbonising city

In recent years, coinciding with the ramping up of urban policies and projects directed at decarbonisation, a growing body of work in geography has sought to examine the shift to low-carbon urbanism and what it might mean for the material infrastructures and social relations of cities (Bridge & Gailing, 2020; Cugurullo, 2018; Hodson & Marvin, 2010). Using buzzwords, such as 'eco-cities' (Cugurullo, 2018; Caprotti, 2014), 'compact cities' (Haarstad, et al., 2023), and 'sustainable cities' (Evans & Marvin, 2006), modes of thinking about locally contained, energy-efficient, and low-carbon life are key focal points in scholarship on urban development. In this chapter, I build on While et al.'s (2010, p. 77) claim that "we are now in an era where the reduction of greenhouse gases – or […] *carbon control* – has become the new 'master concept' (citing: Keil 2007) of environmental regulation" (*my emphasis*). Carbon control – expressed in emissions reduction targets, decarbonising technologies, and new low-carbon materialities, practices, and politics – is becoming a central feature of everyday life in cities. There is a need to examine how contemporary urbanism is becoming dependent on low-carbon practices both in everyday life today and for creating the (environmental) conditions for life in the future.

Platform urbanism comes to light here because, in both "rhetoric and reality" (Schor & Vallas, 2021, p. 369), it is deeply entangled with the modes of carbon control deployed by firms and governments. Digital platforms "do not provide or own physical infrastructures or assets, but act as a service on top of these" (Kloppenburg & Boekelo, 2019, p. 69). However, platforms *are* central to the decarbonising project – decarbonising infrastructures connect with consumers via platforms in and beyond cities across the globe: homeowners are managing distributed energy resources such as solar panels through platforms; businesses are using energy dashboards to track renewable energy consumption and leverage ‘smart’ grid tariffs; EV drivers are locating and activating charge points via smartphone apps. Decarbonising the city relies upon a constellation of connected infrastructures, objects, and devices underwritten by vast amounts of code and configured via platforms. In addition, decarbonizing is frequently encountered through the ‘invisible commodity’ (Miles, 2021) of carbon emissions, which requires “multiple levels of abstraction – both technical (measuring and monitoring between anticipated and actual trends) and value-laden (changing societal trends, market shifts, and policy priorities)” (p. 518), and which gets mediated via digital platforms (e.g., carbon footprint trackers, energy consumption apps, offsetting platforms). A further reason that platform enterprises are central to the decarbonization question concerns their interest and investment in shaping decarbonization pathways in cities. Firms such as Uber trying to steer the decarbonising city, for example by allowing users to connect with low emissions vehicles from the available fleet; by offering ‘sustainability insights’ for business users “to track carbon emissions data, view and report on how frequently employees use low-emission trips” (Uber for Business, 2022, n.p); and by pursuing global lobbying and business activities aimed at expanding EV sales and charging infrastructures (Reuters, 2020; Trudell, 2023). Uber has also “admitted in its IPO that it was competing with public transportation” (Schor & Vallas, 2021, p. 13). The city encounters and experiences decarbonization, in part, via platform enterprises enacting forms of low-carbon restructuring. In short, decarbonisation is mediated through digital platforms.

At the same time, decarbonisation needs to be understood as a process characterized by glitches. For example, as noted by scholarship on sustainability transitions (Geels, 2012; Chandrashekeran, 2016; Wells & Nieuwenhuis, 2012), decarbonising technologies are ‘niche innovations’ (see: Geels, 2014) that entail ‘teething issues’ in their design and operations. Failure here is conceptualised in terms of the success or failure of projects aimed at expanding so-called ‘sustainable’ innovations. We know that technology users are engaged in ‘uphill battles’ in efforts to use and expand decarbonising technologies (Geels, 2014). We know that digital platforms tend to externalise fixed costs, risks, and labour onto users. The upshot: low-carbon pathways are prone to failure and this feature exerts pressures on users to construct systems of maintenance and repair to help stabilize emergent systems. What I seek to examine in the rest of the chapter is the interaction between glitchy platform urbanism and the users and producers of EV technologies in Dublin. I specifically want to consider the ways in which the glitch enrols, and places demands on EV drivers to take responsibility for problems they encounter. How do they try to find solutions; how do they reconfigure the city; and to what extent must their actions occur within the parameters set by platform enterprises?

More broadly, I ask: in what sense are EV drivers and the producers of EV technologies bound up with and forced to negotiate a neoliberal context? Chandrashekeran (2016), for example, argues that failures in transitions emerge, in large part, from disjunctures between global, national, and local agendas. Accordingly, "[a] 'failed transition' foregrounds the potential and limits of agency, showing how actors operate across difference [sic] scales to both transform and reinscribe scalar relations" (Chandrashekeran 2016, p. 1642). Failures to expand adoption of new technologies always must be understood in the context of emerging tensions and disjunctures. In Ireland, as I will explain, neoliberalization works alongside the glitch, which means we should expect negotiation, reconfiguration, and diffraction. I want to examine how glitchy platform urbanism shapes the decarbonising process. In the next section, I discuss the relevance of Dublin for examining the role of glitches in the context of decarbonization and outline my methodological approach.

7.3 Examining the shift toward electric vehicles in Dublin

Like many cities, Dublin's transport system is undergoing a transformation with the emergence of so-called 'low-carbon' vehicles such as EVs, e-bikes, or battery-electric train carriages. Government policy has played a major role, for example via the Electric Vehicle Charging Infrastructure Strategy 2022-2025 (Department of Transport, 2022), which aims to have high-speed charge points every 60 km across the country (p. 12). Subnational strategies such as the Dublin Local

Authority Electric Vehicle Charging Strategy (Element Energy, 2022) have recommended that "… rapid charging should be the priority technology wherever possible. (p. 68)." In addition, new public-private coalitions are aiming to inform policies such as 'the EV infrastructure taskforce', which seeks to govern and promote "transparent and easily accessible data on EV charging infrastructure [by] taking into account digital and information technologies and platforms" (Department of Transport, 2022, p. 42). The shift towards EVs and the expansion of associated infrastructures in Dublin's transportation sector is deeply entangled with the deployment of digital platforms. EV users must interact with smartphone 'apps' or websites to find out where they can charge. Social media platforms are used to share information and offer opinions or feedback about the infrastructure. In-vehicle platforms are common and, in some cases, are required to understand the vehicle's condition.

In this part of the chapter, I examine facets of the shift toward electric vehicles in Dublin. Some background information must be covered. A key element is that, in 2009, the Irish government set out to establish an electric vehicle (EV) market in Ireland (Oireachtas, 2009c) by signing a memorandum of understanding with the Irish semi-state energy company, the Electricity Supply Board (ESB), and the automobile firm Renault-Nissan. Subsequently, EV sales have expanded, with around 84,000 now on Irish roads (SEAI, 2023); a new charging infrastructure has emerged, including around 1,900 public charge points (Arup & Jim Power Economics, 2022, p. 29); and a wave of new EV-related digital platforms have been popularized, such as EasyGo and Driivz (2023), an Israeli electric vehicle charging management software provider. One result is an emerging sense that a so-called 'smart' transition in Ireland's transport sector is underway. As the OECD delegate Pierpaolo Cazzolo stated to the Irish government's Joint Committee on Environment and Climate Action, "the transition to EVs should also be seen in the broader context of other megatrends that can have positive impacts on economic productivity, in particular, digitalisation…" (Oireachtas, 2021b).

Yet, considering the hype about the shift to electric vehicles, one major problem has dampened hopes about this so-called ‘smart’ transition: a limited supply of charge points causes the infrastructure to buckle under the pressure of demand. As noted by the Society for the Irish Motor Industry (SIMI), fast chargers in Ireland’s public charging network are “often not present, offline, located inconveniently or being used (especially when only one charger is available at a location)” (Arup & Jim Power Economics, 2022). The fix, the SIMI suggest, is to scale up infrastructure to around “100,000 public chargers, with all new [charge points] being fast chargers…” compared to the approximately 1,900 currently in place. However, as I now demonstrate, the problem is not so much about supply as it is about the failure of platforms to anticipate the chaotic lived reality of EV users. As I now examine, the bumpy, buggy, and brittle nature of EV platforms betrays the purported ‘smartness’ of EVs, which in turn casts a shadow over their decarbonising potential.

7.3.1 Buggy and brittle EV platforms

The limitation of platforms to support decarbonising action and technologies demands closer scrutiny. I highlight three issues. The first consideration arises because EV users tend to draw upon and engage with an array of platforms. They might use one platform when charging at home, another when using public charge points, and yet others when driving the car, for example to locate charge points or calculate their journeys. The need to use a breadth of platforms frustrates some users, especially when glitches arise, as noted by Respondent 14:

> “I do find one of the major massive irritants is the fact that they [EVs] have all got their own bloody app and card or their own fob or their own random way of arranging their payments […] it's incredibly frustrating as a user…” (Respondent 14, EV user)

Moreover, the coalescence of infrastructures, vehicles, and apps to facilitate features such as ‘smart charging’ adds to the confusion. The result can mean drivers struggle to identify the origin of faults when they emerge, as reflected by Respondent 38 when his new EV wouldn't charge on the public network:

> "I had the app the [ESB] ecars app. Like, I had to ring them, there's a number for help, a customer care number, and she reset the unit and that wasn't working. She tried it again and she was like 'I don't know what to do here'. And then, out of nowhere it just started charging. I said, 'oh it's come on, it's come on' […] So, I found out the next day the previous owners had a home charger and they had it set to charge from 11 [pm] until five [am], so outside it wouldn't charge up and it just so happened when I was on the phone to the E-Cars, it hit 11 o'clock. That was my first [experience with] 'range anxiety'..." (Respondent 38, EV user)

Respondent 38 directed attention to the obscure nature of faults as they are translated or mediated through configurations of different EV platforms with an array of constituent parts. In short, platform urbanism falls short of what EV users actually need, which creates an obstacle to further adoption of this component of the decarbonizing shift.

A second aspect concerns frustrations among EV users regarding interactions with non-networked technologies; technologies that elude the programmability of platforms. For Respondent 60, who works in wind energy sector, this point could be illustrated in issues surrounding 'latent demand':

> "…[ESB] should add a way to record that I want to go to that charger now, but actually, there is somebody at it. So that latent demand is not seen. The fact that I'm sitting beside him, he's charging, I'm sitting beside him waiting. There's another person waiting behind me that is not seen by the system. That's a major block to the development of EVs […] I had people say it me, 'I just got this car, and now I can't get a charge'…" (Respondent 60, energy sector representative)

Latent demand is part of a wider terrain of obstruction that can escape the programmability of platforms in ways that emphasise how platforms are disembedded from the space-times they mediate. This disembeddedness is illustrated by Respondent 5 and 39's comment on the new phenomenon called 'ICE'ing,' which takes its name from the acronym for the internal combustion engine.

> "ICE'ing is when a petrol or diesel car park in front of a charger and stop an electric car user from charging up. It is quite serious, I think, because there are a few apps where you can see what chargers are available. Obviously, if there's an electric car using the charger it shows it's being occupied and that's fine. But, when a petrol or diesel car park in front of them, you don't know in advance that it's the case." (Respondent 5, EV user)

> "So, you look at the app going is the space free in the village. I live in Malahide, and we got about six charging points within about two or three kilometres, but you'd be amazed how many people sort of block them out, and you get down there, and someone's parked a diesel car at it." (Respondent 39, EV user)

ICE'ing demonstrates how the presence of non-networked technology can elude the conditioned expectations of platform mediation, despite no direct breakdown in the underlying software or code. ICE'ing is a glitch against the espoused efficiency of platforms, which intend to remake the city.

A third feature concerns the glitchy condition of the charging network as a whole. A central feature of the interviews highlighted how users looked to platform apps to locate available charge points only to discover a broken or offline infrastructure:

> "The one [frustrating] thing with the [Nissan] Leaf was, if you pull into a garage and the bloody charger was broken or it shows up as working but it's not working…" (Respondent 21, EV user)

Furthermore, the experience of broken, buggy, and brittle infrastructure led some users, such as Respondent 29, to argue that range anxiety, a phenomenon commonly featured in discourses surrounding EV battery range, is better understood as infrastructural anxiety:

> "…you're wondering will the next charger work because we went through a time where the chargers would break and no one fix them for days, because they actually didn't think that people needed them. I think there was a thing there of, 'ah sure look nobody uses them anyway, who cares?' […] I wouldn't call it range anxiety. I would call the infrastructure anxiety." (Respondent 29, EV user)

However, issues surrounding the glitchy condition of the network were not restricted to charge points alone. For example, Respondent 2 highlighted how glitches within the software of the second-generation Nissan Leaf resulted in an 'overheating' phenomenon:

> "…we had about an hour to spend [while the car was charging] so, 'let's go have some fun' […] We came back, and the bloody thing is like 20% charged, and it says another 8 hours are needed […] It wasn't a problem with the charger side [the charge point unit]. It was a problem with the charge side [EV onboard charger] that was known by them [Nissan], there was an overheating 'gate' […] Nissan did a slight recall, they did a software update, and everything and that kind of helped but, you see these are the guys [company] who make the most popular car…" (Respondent 2, EV user)

In summary, platforms mediate the decarbonizing city. There are faults and failures. There is chaos and unexpected interruptions and intrusions. EV users experience frustration and anxiety. EV platforms are buggy and brittle. In response, and as I now discuss, the innovators and entrepreneurs driving the EV industry in Ireland have pursued various practices in an effort to overcome Dublin's glitchy platform urbanism.

7.3.2 From faults to fixes (and back again)

My interviews with public and private sector actors demonstrate how the political-economic forces driving the shift to EVs in Dublin aim to circumvent, or ameliorate for a time at least, some of the tensions emerging from platform faults. Three features stand out. Consider, first, efforts to recast the size and geographical reach of platform infrastructures. One key practice relates to the construction of EV charging 'hubs.' As illustrated by Respondent 46:

> "… The stuff we're putting out is all rapid charging DC […] which is 150-kilowatt charging, and ordinarily, six to 10 bays, so proper hubs […] You're not going to have to wait to charge. You don't have to worry about the unit being out of order. And so, with that assurance, the old dog that worries the EV sheep is that fear associated with that anticipation, and anxiety around the ability to get a charge […] That's if I get there, can I charge? Will there be an ICE car block in front of it? Will it be working? Will there be somebody else on it? Will they get off within a reasonable period of time or will I be sat there for hours? All these. So, we're fixing that." (Respondent 46, charge point operations representative)

Instead of directly reengineering the platform's underlying software/code, EV charging hubs demonstrate how localities can be reconfigured by efforts to fix the inadequacies associated with platform technologies. However, the construction of EV charging hubs depends upon the production of proximate but extra-local and capital-intensive configurations, which can create barriers for firms to invest, as noted by Respondent 49:

> "…you take DC chargers, the price of them straight away enter thousands of pounds or tens of thousands of pounds […] Everybody needs a little bit of help at the minute, to put the cart before the horse […] people will be refraining from buying until the media starts to portray a better charging network…" (Respondent 49, charge point operation representative)

'Putting the cart before the horse', per Respondent 49, reflects the issue of building hubs before demand. Yet, the ability and willingness of firms to invest in hubs is limited by Ireland's unique approach to EV infrastructure rollout. According to journalist Neil Briscoe (2021, n.p), "[s]tate support to date for public charging seems to be solely for state-owned rather than privately-owned entities…". For Respondent 52, therefore, Ireland's unique approach to infrastructure rollout, in conjunction with its small population and land area (relative to mainland Europe), creates challenges for firms to pursue economies of scale:

> "The leader in the space [ESB ecars] is government supported which is what you need to build out this infrastructure […] The commercialization of it is there, it's available, it's possible. It's just hard for us to give stuff away for free […] I was talking to a guy who is talking about putting chargers on lay-bys on motorways, you know, building charging station hubs at lay-bys on motorways, I mean, it's an interesting concept. [The] country is not big enough […] there are four big roads in Ireland effectively, they'll be covered by the ESB [ecars]." (Respondent 52, energy sector representative)

Second, if there are limits to the potential for economies of scale to prevail, an alternative approach has been to enhance the interoperability of the infrastructure. A crucial component of this strategy relates to how firms promote and draw upon new international standards such Open Charge Point Protocol (OCPP). Respondent 54, for example, highlighted how OCPP enabled their firm to strategically pivot from infrastructural installations to a value-added service approach built around software:

> "… we wanted to put hardware out there for public use and to sell electricity but it was very, very difficult because ESB has such a stranglehold on the market [but] what they've stipulated in Europe is that public chargers have to comply with OCPP standards […] basically networks, charging networks that are put out by private companies have to be made available to anyone, not just their own network of users […] Now a number of companies have popped up where they're providing the software to allow all these different companies [to interoperate] […] GIREVE would be the main one that our software is connected to […] it shares all the access user data across all these different third-party providers. So, when we add users to our database, it's shared with all this wider European database so when they present an RFID card it's recognized in all these other third-party infrastructures across Europe. So, we didn't have to develop that software as such, we just had to connect to that software with our software..." (Respondent 54, charge point operation representative)

Per Respondent 54, OCPP has created a significant entry point for smaller firms who otherwise struggle to compete in the harder engineering segments of the EV infrastructure markets. In addition, the shift towards interoperability has resulted in efforts to integrate the constituent parts of EVs into platform configurations in new ways. As Respondent 54 noted, the emergence of 'Plug and Play' capabilities are constitutive of a new arena of interoperability:

> "… Plug and Play is basically where you take the RFID or tag or card out of the equation or an app even […] Instead of that, the car communicates with the charger […] the fast charger is going to have

> a connector on it that gets plugged into the car. There's an electronic handshake that happens there that identifies the car on the charger and then all the data transfer happens as a consequence of that electronic handshake.” (Respondent 54, charge point representative)

New interoperable innovations such as Plug and Play are a vital component behind efforts to develop what some scholars call ‘the internet of energy’ (Mahmud, et al., 2018; Hannan, et al., 2018) because of the ability of plug and play to integrate and automate central energy infrastructures. Yet, efforts to incorporate other so-called ‘smart’ features from the energy sector into platforms have not been successful. Respondent 52, for example, shed light on the limitations and inflexibility of features such as ‘smart tariffs’ in the Irish energy market:

> “The whole idea […] was that the Ohme cable would, through some very clever software, choose the cheapest greenest energy at the most effective time for you, but you see, we don't have interoperability between the various [energy] providers. So, if I sold you an Ohme cable, it would only work with Pinergy or whomever your [energy] provider was.” (Respondent 52, energy sector representative)

In turn, the inability to design flexibility and interoperability in the delivery of ‘smart tariffs’ betrays the purported ‘smartness’ of platforms, as noted by Respondent 56:

> “…our smart tariffs in Ireland are like, you know, free energy maybe at a certain time for two hours in the day or reduced energy on a weekend day. That's not smart […] They're not intuitive. They're not interactive. They're not smart […] it's just different prices, it's bands […] All these smart tariffs are what have been around for tens of years on the b2b [business to business] side…” (Respondent 56, energy sector representative)

Efforts to promote interoperability entail a mixture of headway and hype because standards such as OPCC appear to make strides towards a type of scale efficiency. Yet, the inflexibility and inability to incorporate wider smart features such as 'smart tariffs' limit the potential of moves such as OPCC.

A third and final example of efforts to circumvent some of the tensions emerging from platform faults concerns platform-mediated maintenance and monitoring of the infrastructure. The ability of firms to provide a distributed network at scale hinges on their capacity for maintenance and repair. A crucial component of this capacity relates to the roll-out of remote digital technologies to monitor the condition of platform infrastructures. Such practices have been a part of monitoring the condition of the vehicles themselves since the EV sector began, as noted by Respondent 25:

> "They [Greenaer] provided fantastic support, you know, they would come down and repair the cars, they would remotely take control of the car if necessary and run a diagnostic test […] And this is, this is 2010. This is for quite a long time ago. For someone in Dublin to be remotely taking control of an EV." (Respondent 25, EV user)

The practice of load monitoring and maintenance has expanded into the charge point operations segment of the sector. According to Respondent 57, a central feature which allows their firms to install a distributed network of chargers relates to their ability to monitor the infrastructures from a distance:

> "…when I started this, I knew that logistics was going to play a huge part […] I spoke to you about, there about, heat being the enemy of electrical components. Every one of our chargers, AC and DC, I can dial into anyone of them now, or if I'm at home this evening, and I can see what the temperature is inside. So as part of regular maintenance that we do, it's not even maintenance, they're checks that we do, we run the diagnostics on all of our chargers, to see how many chargers

> have been heating up and going above a certain temperature […] we can keep an eye on things like that, and look for inconsistencies and look to see, you know, maybe do some fault finding […] a lot of that would have come from my background [in] maintenance and automation, where I would have used tools and use things to try and predict failure.” (Respondent 57, charge point operations representative)

As demonstrated by Respondent 57, monitoring charge points requires drawing upon new distributed sensor networks and the on-demand integration of their data to help manage the scale of maintenance and repair involved in decarbonising the city. Although the developments associated with load and maintenance monitoring have been encouraging for firms attempting to construct new scalar practices, several EV users and private and political actors have suggested such efforts are secondary to the wider political-economic organisation of the infrastructure. Recall the point I made in Chapter 4 where, from a period between 2017 and 2019, several respondents indicated that charge points were left unmaintained due to the uncertainty of who owned the charging network. As demonstrated by Respondent 42, maintaining and repairing the infrastructure is deeply connected to wider structured coherence of the EV sector:

> “ESB were given the task, as I said, by government to develop a charging infrastructure when they could see no market for it […] ESB, then, and in my mind quite rightly, questioned the market value of that charging network and questioned the ownership […] unfortunately, what happened was, the decision went to the Commission for Energy Regulation, as it was known then, and now the Commission for the Regulation of Utilities […] herein lies one of the problems. So, they took 18 months to come to a decision about who owned that network and what would happen to it in the future […] basically, they failed, and they postponed the possibility of further investment, not only by ESB but by leaving it in an undecided state […] that's actually the truth

> behind that period where, you know, charge points were left non-service and non-maintained […] because it was free, there's no revenue stream coming back into ESB." (Respondent 42, automotive sector representative)

Clearly, the various practices deployed by private and public sector actors fall short of the type of action needed to scale up infrastructures and fix the multiple faults EV drivers encounter. Moreover, the fixes pursued by firms are undermined by Ireland's unique political-economic configuration. The result, according to Respondent 58, is an incoherent EV scene:

> "So, it's a bit of a wild west scenario at that moment. It's kind of like everybody's waiting for the dust to settle and see where all this is going to land." (Respondent 52, energy sector representative)

The three issues discussed above highlight how Dublin's EV transition has failed to live up to the 'smart' hype.

<u>7.3.3 Fixing glitchy platform urbanism via generative digital geographies</u>

In this sub-section, I demonstrate that EV users try to establish a more coherent urbanism that moves beyond the glitches, bugs, and breakdowns they encounter. What EV users produce and promote is a range of generative digital practices to paper over the cracks in the platform faults they encounter. I have two points to make.

The first relates to the role of social media in supplementing the various challenges users encounter. In fact, for users such as Respondent 25, social media sites such as Facebook play a more significant role in mediating platform faults associated with public charging networks than many apps designed for that purpose.

> "I would check out the other Facebook pages and the association [Irish EV Owners Association's Facebook page] because particularly, if I'm

> going on a longer journey, like it's really important to. I find that, in many ways, that's the most reliable way to know what chargers are down. More reliable really than the map [ESB charger map]." (Respondent 25, EV user)

According to Respondent 25, the role of social media demonstrates how EV users survey multiple mediations of the city before engaging the physical landscape. Social media also enables users to connect in real-time and troubleshoot issues as they arise. For example, Respondent 20 reveals how social media helped to educate them on charging:

> "I find the UK one [Volkswagen ID3 users UK Facebook group] better because you get more tips. I suppose like nobody is going to be writing positive things on it, everything is a negative, 'how do you fix this' […] when I got the car first, and this is going to sound stupid, like it wasn't really explained to me how to charge at a charging station, you know. So, I went over to my local charging station […] I took my cable out of the booth, I plugged my cable into that cable and then my cable into the car, and then I was wondering why isn't it working? […] Then from the site [ID3 UK], a gentleman said, 'ring me'. So, I rang him, and he talked me through it, that actually, I don't need to use my cable, only when there is no cable […] I felt like a right ejit..." (Respondent 20, EV user)

How EV users engage social media directs attention to the possibilities for connecting with and drawing upon extra-local actors and knowledge. EV users such as Respondent 20 are engaging the experience and expertise of extra-local users that transcends the nation-state as the primary container for the social relations underpinning decarbonizing action. Diverse geographies are involved in modulating and engaging platforms. Glitchy platform urbanism touches down in cities such as Dublin in unexpected yet productive ways. Such actions outside of the platform call attention to tactics and practices deployed by users that subsidize the overall platform architecture and ecology. Generative digital geographies emerge as users try to make and put to work a more coherent urbanism to let them move beyond the glitches they encounter.

A second set of generative digital geographies arises when EV users support one another in more elaborate ways. Beyond providing ad hoc advice, some EV users have contributed to the creation and promotion of 'grassroots' platforms, such as NeedToCharge:

> "There's an app [Need to Charge] which you can use […] it knows that you're charging in, say, Waterford station […] Say if it's your car, I can send you a message saying 'how much longer are you going to be? I've been waiting an hour here'. Then it's a sort of courtesy thing. You say, 'ah shit, somebody's waiting for it. I've got enough. I'll leave'..." (Respondent 29, EV user)

NeedToCharge was created in the UK by Chris Schofield, an 'EV enthusiast' (2020, n.p). It is popular with some but not yet used by all EV drivers:

> "I can send it to you that I 'need to charge', and then you come back, say 'right, I'll be another 10-15 minutes'. So at least you know where I am. You haven't sort of disappeared for 5,6,7 hours […] So, it's a good idea. But it's still voluntary […] But I can imagine if there is [sic] a lot of EVs on the road and then charging points. You got somebody sitting there for six, seven hours, there's going to be murder…" (Respondent 32, EV user)

Apps like NeedToCharge provide a mode of communication for users in the context of opaque platform infrastructures. It takes advantage of the affordances of platform-mediated life to overcome some of the glitches and inadequacies of the decarbonizing shift.

Another way to see generative digital geographies emerging to overcome glitchy platform urbanism concerns efforts by some EV users to alter or hack platforms. For example, Respondent 20 shed light on efforts to alter the in-vehicle media to facilitate Android operating systems:

> "There's a guy in the Czech Republic who has the software that you can get into Renault's system. It's a lot of different software switches, but you'd need to read through them […] we had a committee meeting down in Waterford in the summer, and after the meeting in the carpark, he did it with a laptop in about 20 minutes […] At the time, they had a TomTom, I think, as standard in the Renault. Don't forget they built like a new motorway beside me. So that won't be in it [the TomTom platform]. I don't even know when they upgrade your software, they usually upgrade diagnostics, they won't put in new TomTom stuff […] But because of the software that he changed, it just added a little button on my screen, which if I plug in an Android phone into the USB […] it will switch to the Android operating system and load it onto the screen of the car." (Respondent 20, EV user)

Respondent 20 draws attention to efforts to reshape the everyday functions of the car in the light of the rigidness of in-vehicle platforms such as TomTom. In addition, Respondent 20 demonstrates how hacking the vehicle relates specifically to features of EVs as the relationship between diagnostic tools, battery health, and range become new arenas for contesting the opacity of platform architectures:

> "On the IEVOA [Irish Electric Vehicle Owners] website, there are four or five little dongles you can get [that] plug into the car, and they work on Bluetooth. Then you have software on your phone. So, you can actually see what like, the battery might be like […] So, people think it's a big battery, but it's maybe 100 or 200 cells, it will tell you all of those cells, what percentage they are operating at. So, it will do a whole load of different things, a lot of diagnostic stuff. Stuff they're

> probably using when you bring it in to get service […] But a lot of the service engineers are only being trained at the moment anyway […] my engine went in September, and I've got about 100,000 kilometres out of it, but it took them like 10 weeks to get someone to sort it, and then after 10 weeks, what they found out was wrong with it. I told them." (Respondent 20, EV user)

For Respondent 20, attempts to hack and alter the vehicle's software were driven by a desire to be "kind of pioneering [and to] kind of find your own *fix* to things" [Respondent 20; my emphasis]. Such efforts to overcome some of the inadequacies in the opaque and misconfigured components of EV platforms exemplify generative digital geographies playing a part in expanding the decarbonisation shift.

7.4 Conclusion

The emergence of ubiquitous and pervasive digital networks, data, and connected technologies in cities has led to the rise of digitalisation models and imaginaries aimed at reconfiguring the space-times of, and extracting data from, urban environments. Platform urbanism emerges as a useful concept to understand how such models touch down in 'actually existing' contexts to shape the city. This chapter focused on the glitchy motors of platform urbanism in the context of the shift to EVs in Dublin's transportation system. Drawing upon digital geography literature on the notion of the glitch in platform urbanism, and a wider terrain of scholarship on low-carbon and sustainability transitions, I argued that the 'buggy and brittle' nature of EV platforms in Dublin exerts pressure on actors to strategically pivot, circumvent or 'fix' many of the platform faults they encounter. The experience of actors in Dublin resonates with approaches to low-carbon and sustainability transitions that understands niche innovation as facing "an uphill struggle against existing systems" (Geels, 2014, p. 37). Glitches are features of this struggle to draw upon, expand and connect platform technologies in effective ways. In their struggle, however, actors are not simply tolerant of risks and faults but rather develop and promote a range of creative actions that enable the shift to

EVs to continue, despite the technical inadequacies. I demonstrated how public and private sector actors fall short of producing the type of fix capable of fully resolving the tensions emerging from platform faults. As a result, I argued EV users are forced to become resourceful by pursuing generative digital geographies via platform-mediated practices, interactions, and the formation of new networks.

Looking beyond Dublin to understand the broader significance of this chapter, I conclude by arguing that the glitch provokes a type of neoliberal project redux in which the responsibility to fix climate action lands on individual EV users. I have worked with the concept of the glitch to demonstrate its centrality to national and subnational decarbonising policies, projects, and strategies in Dublin. The decarbonizing process 'comes to ground' in Dublin in a fault-prone, failure-heavy way. In my view, the glitch is generative of the decarbonising process itself, specifically through the 'error-erratum' interplay, which then gives rise to EV users pursuing new platform-mediated fixes. However, instead of viewing the decarbonising process as a potential arena to be "modulated, diffracted, or (re)made along counter-topographical lines" (Leszczynski, 2020, p. 197), I want to suggest that the glitch works for firms by outsourcing and to an extent devolving the responsibility of climate action on individual EV users. In this regard, efforts to 'fix' Dublin's glitchy platform urbanism go some way toward reproducing a buggy and brittle decarbonizing economy characterised by neoliberal mentalities. Of relevance here is a general feature of capitalist societies, which depend on (free) repair, care, and reproductive labour (Graham & Thrift, 2007). Moreover, per Vecchio et al. (2022), a core feature of platform-mediate life is that lead firms always seek to externalise costs, risks, and labour onto users. The technicity or the productive power of technology to make things happen is reinforced by the creative actions of users when platforms break down or glitch. What EV users call attention to is the distributed, creative, and at times odd nature of maintenance and repair under platform urbanism. Practices such as troubleshooting on social media platforms, grassroots app development, or hacks can occur outside of platform architectures, but they work by propelling the decarbonisation process in general and thereby reproducing rather than ever moving beyond the broader neoliberal framework in which urbanism unfolds. The result is that new generative digital practices, new networks, and new communities *qua* publics emerge against the backdrop of Dublin's glitchy, faulty, and inadequate decarbonising project.

Chapter 8: Conclusion

8.1 Introduction

Electric Vehicles (EVs) and their associated infrastructures are emergent technologies that have become a cornerstone of the global decarbonising project. In this dissertation, I focused on the role of EV users and public-private sector actors in driving the shift towards EVs in Dublin. I was concerned with how efforts to decarbonise the city produce and draw upon novel relationships between the state and capitalist firms alongside EV users. I also brought into focus the 'lively practices' of actors (Morris, 2016) – their market interactions and performativities – shaped by the place-specific dynamics of Dublin's turn to EVs. As such, in the preceding chapters, I unpacked and problematised the spaces, modalities and pathways underlying efforts to decarbonise transportation in Dublin. In the process, I addressed the project's overarching research question: How do alliances of public-private actors and EV drivers assemble, mobilise, and drive efforts to decarbonise Dublin's transportation sector?

To answer this research question, I engaged with an emerging but diverse literature on 'transitions' in human geography and placed three separate fields into conversation with one another to construct my research framework, which I referred to as critical urban transition studies (CUTS). I drew upon scholarship engaging the multi-level perspective (MLP) on sustainability transitions, urban political ecology (UPE), and Marxian approaches to urban development. I reviewed the key contributions from each field in the context of social, environmental, and economic transitions. My argument was that by combining elements from each field, I could apply CUTS in ways that help to bring to the surface the messy and contested but nevertheless vital connections emerging between 'sustainability' innovations, nature, and society, which underlie the turn to EVs. Moreover, I argued that these approaches permit an analysis of the imaginaries and (inter)actions expressed on the ground in cities that, on the hand, seek to provoke shifts in the fabric of society towards a more popularly framed ‘sustainable’ future but, on the other hand, do so in ways that maintain the power relations and structures which created the climate problem in the first place.

I chose a qualitative framework to engage with actors on the ground because it provides an in-depth analysis of the viewpoints and social worlds of different social groups (Denzin & Lincoln, 2011). Over the course of my fieldwork and analysis, I identified four core research findings and reported on the evidence base that supports each finding:

1. Dublin’s EV project can be understood as producing an ‘inadequate infrastructure’ that constrains the objective of decarbonising the city.
2. Dublin’s EV project was underpinned by ‘incoherent imaginaries’ regarding the so-called environmental reason for adopting, using, and expanding EVs.
3. Dublin’s EV project was shaped by ‘inconstant and insufficient interventions’ by the public and private sectors.
4. Dublin’s EV project gave rise to ‘imaginative and iterative responses’ by EV users to stabilise the EV project.

In the analytical chapters, I applied CUTS to the core findings to conceptualise why Dublin’s turn to EVs falls short of producing the type of restructuring project needed for meaningful decarbonisation to occur. I began my analysis by drawing upon scholarship engaging the MLP to analyse the ‘inadequate infrastructures’ emerging from Dublin’s first EV charging network and trace its connections with a pilot scheme known as ‘the EV pilot project’. I shed light on how this pilot scheme gave rise to configuration failures where the infrastructure lacked any real coordination with EV sales, appeared inconsistent with the wants, needs, and desires of EV users and was overall incongruous with Dublin’s urban form. I then draw from scholarship engaging UPE to explore the contradiction, conflicts and tensions entangled with the socio-natural imaginaries driving Dublin’s turn to EVs. My aim was to shine a light on the less noticeable or obscure connections between EVs and the ecologies that underpin their adoption, expansion, and use.

These connections painted a picture of the 'incoherent imaginaries' underlying the turn to EVs where efforts to bolster a privatised, individualised, and hypermobile transport system – designed around long-range batteries and high charging speeds – limited the capacity of the state and firms to develop infrastructures thereby undermining decisive and timely decarbonising action.

At the same time, I demonstrated why it is important to view developments in Dublin's EV sector in the context of the 'inconstant and insufficient interventions' made by the public and private sector. My analysis highlighted the ways in which a wide terrain of public sector actions has sought to shift Dublin's turn to EVs towards a more market-oriented project. Semi-state firms such as ESB ecars commercialised what were publicly funded infrastructures with a view to 'upgrade' and expand the charging network. In addition, Dublin's local authorities sought to outsource infrastructure developments to the private sector. However, under closer examination, these 'growth first' strategies to decarbonise were undermined because the conditions to accumulate via public charging had not yet matured to a point where private sector actors could justify investing. The upshot was the emergence of new waves of government subsidies aimed at enticing private investment, on the one hand, and the rise of premium providers that fragment access along socioeconomic lines, on the other hand. What developed were environmental-economic tensions that generated an overriding sense of inertia. The inconstant and insufficient interventions failed to produce a dominant set of strategies or visions of what the EV project should look like. I argue that these developments must be understood in the context of 'actually existing neoliberalism' in Dublin (see: Hearne, 2014; Mercille & Murphy, 2019), whereby public and private sector actors sacrifice sustainability objectives in the pursuit of growth-oriented development.

In turn, I have argued that to stabilise and develop a level of coherence around Dublin's EV project, the state and automobile firms rely on the 'imaginative and iterative responses' of EV users who seek to stabilise the EV project. I utilised a paper I published (Ó Maonaigh, 2023), which draws upon my doctoral research to shed light on the odd structure of class relations involved in the formation of new accumulation strategies, spaces and fixes capable of holding together, for a time at least, some of the tensions emerging from the chaotic unfolding of EVs and associated infrastructures in cities. I argued that EV users in Dublin forge novel cross-class alliances with automobile firms with a view to promote EVs and sustain private and commercial automobility as the core of the decarbonisation agenda. Furthermore, I argue for the need to conceptualise the decarbonising action of EV users as part of a wider class project intended to enrol wealthier users in a push to alter the city and produce uneven pathways of decarbonisation.

I finished my analytical chapters by synthesising the four core findings and considering how my digitally mediated research methodology shaped the outcomes of my research. I critically analysed the presence of glitches, breakdowns and failures in the technologies and infrastructure configurations underlying the EV project. I examined how breakdowns in the digital systems reflect a type of climate action project that devolves responsibility on individual EV users to seek fixes, circumvent or ameliorate, for a time at least, some of the tensions emerging from a buggy, brittle, and inadequate decarbonising project. This aspect of the research emerged as a surprising feature of my digitally immersed research methodology, which brought to the surface the intimate ways in which digitalisation objectives shape the decarbonising process.

For the remainder of this concluding chapter, I report on the core research findings before outlining my reflections on the implications and significance of the results. I then turn my attention to reimagining how applications of CUTS might be developed in the future in useful ways. Finally, I bring the dissertation to a close by articulating the need to pursue what I refer to as ‘deep greening’, which might allow for a more timely and decisive decarbonising agenda to emerge.

8.2 Core research findings

In this section, I report on the four core research findings that I summarise in Table 8.1. I note that all the findings are connected and, therefore, have considerable overlaps. Therefore, I reflect on the findings separately, but the insights have have left an imprint across all analytical chapters.

Table 8.1 Summary of core research findings

1	Inadequate infrastructures that constrain the objective of decarbonising the city i. Early efforts to develop the infrastructure were deeply experimental, which led to a slow-moving project. ii. The infrastructure was limited and frequently broken. iii. The geography of the infrastructure was marginal, fragmented, and inconsistent with the urban form. iv. Innovation shifts and competition around charging technologies created conflicts between different user requirements.
2	Incoherent imaginaries regarding the so-called environmental reason for adopting, using, and expanding EVs. i. EV users' adoption was influenced by the lack of alternative low-carbon transport options (e.g., cycling infrastructures). ii. EV users frequently prioritised local environmental transformations over any concerns around climate change. iii. EV users' adoption was influenced by the emergence of long-range batteries aimed at reducing issues relating to range anxiety. iv. EV users' adoption was influenced by high-speed charging infrastructure aimed at reducing issues relating to range anxiety and charging times. v. EV users tended to deny any responsibility for negative socio-ecological transformations emerging because of the EV project.
3	Inconstant and insufficient interventions by the public and private sectors

	i. The Irish government lacked the resources for long-term investment in infrastructure. ii. The Irish government struggled to coordinate interventions at various scales. iii. Private sector firms hesitated and resisted investing in EVs and associated infrastructures. iv. Private sector firms struggled to develop a coherent and consistent business case for investment in infrastructure.
4	Imaginative iterative responses by EV users i. EV users promoted a culture of care for the network to help ameliorate the tensions of the failures surrounding the infrastructure. ii. EV users formed organisations and groups to lobby the government for better infrastructure. iii. EV users forged alliances with automobile and charge point operation firms to help nurture and stabilise the EV project. iv. EV users promoted and pursued a range of digitally enabled practices to help ameliorate the tensions of the failures surrounding the infrastructure.

8.2.1 Inadequate infrastructure

My analysis led me to argue that a first core research finding is that the shift towards EVs in Dublin can be understood as producing an 'inadequate infrastructure' that constrains the objective of decarbonising the city. Four forms of evidence led me to reach this conclusion. First, among the respondents who engaged with this component of my research, there was a tendency for them to argue that 'urban experimentation' gave rise to an inadequate infrastructure in Dublin. Respondents reported that early efforts to roll out infrastructure were deeply experimental in nature. As a result, the network was slower to expand than EV users had expected.

Second, respondents argued that the publicly accessible charging network was substandard relative to the wants and needs of EV users. Respondents highlighted how the infrastructure was frequently unavailable because the charge point network did not expand at the same rate as EV purchases, resulting in long queues. In addition, respondents reported that charge points were frequently offline, broken, and awaiting repair for potentially days or weeks at a time.

Third, respondents reported that the geography of the charge point network was often fragmented and inconsistent with the urban form. EV users argued that the locational decisions of firms for infrastructure were incoherent, with some areas covered and others ignored, as well as charge points being frequently located in marginal areas such as the industrial estates and hotels. In addition, EV users described how the locations selected for charge points were often unmanaged by any authority and situated at the periphery of the sites themselves, for example, at the backend of car parks. According to respondents, this marginalisation led to various obstructions at charge points, such as internal combustion engines (ICEs) blocking chargers.

Fourth, respondents reported that innovation shifts in charging speeds, standards and specifications created conflicts between different user requirements. Newer EVs tend to require faster chargers. In this regard, respondents argued that the infrastructure was lagging behind because of the lack of high-speed charging. In addition, EV users highlighted how the emergence of different charging standards produced conflicts between different user requirements. For example, reports suggested that many highspeed chargers could not simultaneously deliver power to more than one EV if either vehicle used a different charging standard (e.g., CHAdeMO versus CCS standard). Moreover, respondents noted that high-speed charge points often could not deliver their advertised charging speed due to the lack of local power available on the electricity grid as well as uneven charging capacities depending on the in-vehicle battery chargers.

8.2.2 Incoherent imaginaries

A second core research finding I identified through my analysis is that the shift towards EVs in Dublin is underpinned by 'incoherent imaginaries' regarding the so-called environmental reason for adopting, using, and expanding EVs. Five forms of evidence lead me to reach this conclusion. First, the respondents who engaged with this component of my research reported that EV users frequently prioritised local environmental transformations over concerns for climate change in their environmental reasons for adopting an EV. This emphasis on local environments reflected an overall sense that EV users as a whole would benefit more from the local effects of adoption, such as reduced noise and air pollution, rather than decarbonisation. EV users were often unmoved by concerns over carbon emissions and obscured climate change in the periphery of their reasons for adopting an EV. Moreover, EV users frequently reported that the kinaesthetic and emotional dimensions of using an EV took precedence over concerns over climate change in their environmental reasons for adopting an EV.

Second, respondents reported that Irish economic and urban development's connection automobility limited the scope to pursue alternative low-carbon modes of transport, for example, cycling or public transport. They argued that the tendency for urban sprawl and semi-detached housing to feature in Irish planning, the presence of long commuting patterns, and the lack of development in public and active transport pathways have 'locked-in' automobility at the centre of Dublin's transportation system. Given this dependence on automobility, respondents argued that EV use was the only effective option for individuals seeking to travel in more 'environmentally friendly' ways. Seen in this light, the turn to EVs was as much influenced by path-dependent conditions than a purposive climate mitigation strategy.

Third, respondents highlighted the centrality of 'battery range' in their decision to adopt an EV. A key issue here relates to the notion of 'range anxiety', which refers to the fear that an EV will run out of battery range before reaching its destination. EV users highlighted how range anxiety connects with the hypermobility of daily lives – commuting, school runs, shopping – longer commuting practices that can create heavy demands on energy consumption. However, EV users suggested that concerns over battery range were manageable insofar as charging their EV became part of the self-organising nature of everyday life. Where EV users reported range anxiety to be most pronounced was in longer or unexpected trips, for example, when visiting a friend in the countryside or during a medical emergency. In fact, several users noted that range anxiety was about their capacity or potential to travel. In this regard, attempts to address range anxiety connected more with efforts to reproduce the conditions for hyper and imagined mobility rather than cohering with any resources that were available to decarbonise.

Fourth, respondents reported that efforts to extend the battery ranges of EVs created a high demand for more capital- and resource-intensive configurations. Respondents argued that issues relating to 'range anxiety' have become less significant as larger battery sizes have come on stream with newer EV models. However, the upshot of bigger battery sizes was a greater demand for faster charging for those EV users who needed publicly accessible infrastructure. At issue was developing a high-speed charging infrastructure required a level of investment that respondents argued was not viable given the low uptake of EVs in the Irish market. Respondents also argued that one key reason for the low uptake of EVs was the lack of publicly accessible charging infrastructure. In short, respondents pointed to a chicken-and-egg situation that contributes to the overall inertia of the shift to EVs.

Fifth, respondents neglected the responsibility for the distant and negative socio-ecological transformations due to expanding EV adoption and range. EV users recognised that the turn to EVs produced novel resource intensities, for example, via the extraction of critical raw materials or in the production of renewable energy. However, EV users argued that the host countries where extraction occurred were responsible for any negative socio-ecological transformations that might emerge due to the expansion of EVs. In addition, EV users tended to consign any solutions for distant and negative socio-ecological transformations to an array of potential technological and spatial fixes. For example, respondents argued that automobile firms had intended to eliminate critical raw materials from the battery manufacturing process through investments in solid-state battery innovation. Along similar lines, respondents also suggested that automobile and mining firms had aimed to relocate upstream activities to more developed countries with 'less extractive' institutional landscapes. Thus, eliminating any socio-ecological harm and exploitation from the production process.

8.2.3 Inconstant and insufficient interventions

The third core finding shed light on 'the inconstant and insufficient interventions' by the public and private sectors that shape the shift towards EVs. Four forms of evidence led me to reach this conclusion. First, the respondents who engaged with this component of my research argued that the public sector interventions underlying the turn to EVs were incapable of delivering the long-term investment and action needed to develop and maintain infrastructure. Public sector respondents argued that their organisations lacked the resources and expertise needed to install and operate a publicly owned infrastructure. They highlighted issues such as expenditure restrictions and the lasting effect of austerity policies on public workforce planning. As such, public sector respondents reported feeling compelled to facilitate and support a market approach to mobilise decarbonising action. In this regard, public sector respondents brought into focus some of the strategies they have pursued to mobilise the turn to EVs, including constructing roadmaps, plans, and designs to provide stronger market signals to infrastructure firms. In addition, the Irish state provided subsidies such as tax breaks and grants to entice investment into Dublin's EV project.

Second, respondents reported that the Irish government's overall approach was inconsistent and struggled to coordinate interventions at various scales. In the context of Dublin, the Irish government devolved much of the responsibility of rolling out EV infrastructure to the four local authorities, who, in coordination with the Climate Action Regional Offices (CAROs), sought to install EV charge points across the city. However, the local authorities struggled to deliver on the project, only installing 33 charge points between 2019 and 2022 compared to the target amount of 200 per annum (Dwyer, 2022). On the foot of this failure, the local councils pivoted towards a more market-oriented approach. The upshot, respondents argued, was an inconsistent vision of the EV project that hindered the expansion of EVs and associated infrastructures.

Third, respondents reported that various private-sector firms hesitated and resisted investing in EVs and associated infrastructures. For example, reports indicated that the automotive sector inhibited the transition by seeking to maximise the sales of internal combustion engines. For example, several accounts highlighted how automobile dealers in Dublin were unwilling or hesitant to sell an EV to customers, in many cases, directing individuals to petrol or diesel equivalent. These claims were substantiated by the presence of groups such as the Irish Car Carbon Reduction Alliances (ICCRA), a lobbying group comprised of car dealerships across Ireland, who have lobbied the government to push their EV targets by ten years to 2040.

Fourth, in the context of infrastructure, private sector respondents argued that some home-charging installation companies were artificially inflating installation costs, that the turnover times for publicly accessible charge points were too long because of the high costs associated with grid connections, and that the state undermined private sector investment by subsidising and funding ESB ecars.

8.2.4 Imaginative and iterative responses

The fourth and final core finding led me to argue that the shift towards EVs in Dublin can be understood as giving rise to ‘imaginative and iterative responses’ by EV users to stabilise the EV project.’ Four forms of evidence led me to this conclusion. First, EV users promoted a culture of care for the network to help overcome the inadequacies they encountered. One crucial component here relates to how EV users develop and deploy a new language around novel practices and phenomena such as ‘charging etiquette’, ‘charge hogging’, and ICE’ing, all of which direct attention to the ways EV users seek to simultaneously govern and contest the spaces of charge point infrastructures in ways that can ease the burden of the inadequacy they face.

Second, EV users formed collectives at various scales to lobby the government for better infrastructure. This evidence could be demonstrated in the emergence of groups such as the Irish Electric Vehicle Owners Association (IEVOA), a lobbying organisation for EV users in Ireland. Respondents highlighted some of the ways IEVOA aimed to educate the public on EV adoption and use, lobbied the government at a variety of scales for better communication, infrastructure, and subsidies for EVs, and collaborated with the public and private sector via government-led steering groups such as the Dublin Region EV Charging Working Group. IEVOA is connected with a range of sub-EV owners’ groups across Ireland, such as the Dublin EV Owners Club, and respondents placed a significant emphasis on the importance of the organisation in promoting the EV project as well as helping to fill the void left by the type of inadequacies EV users face.

Third, building on the two previous points, my analysis highlighted how EV users build alliances with automobile and charge point operation firms to help stabilise the EV project. EV users highlighted how they build implicit alliances with firms, for example, by promoting certain brands that appear more committed to the EV project or by evangelising EVs within their social interactions with others – at home, work, or in more mundane interactions at petrol stations. At the same time, EV users reported on the emergence of more explicit alliances with firms, for example, by accepting financial support from firms such as Nissan to host annual car club AGMs or by providing seminars and workshops to car dealerships to inform them on the challenges and dynamics of EV adoption and use.

Fourth, EV users promoted and pursued a range of digitally enabled practices to help stabilize the transition. The EV users who engaged with this component of my research highlighted the centrality of digital platforms in using an EV. However, respondents highlighted how platformisation also adds to the overall inadequacy of the EV project because the buggy and brittle nature of digital technologies tends to enhance the chaotic and unexpected experience of using an EV. In turn, EV users reported on efforts to forge a range of relationships with other users online as well as creating and promoting alternative digital platforms, apps, and tools to help circumvent some of the buggy and brittle experiences when using an EV. One key point here is that the relationships users forge were both extra-local – learning online from the experiences of EV users from foreign cities – and non-synchronous – drawing upon old content created by other EV users online.

In addition to these primary research findings, the analysis drew upon material through repositories, such as LexisNexis to generate secondary data. I argue that this secondary data helped to frame and steer the overall direction of the research in three ways. The first way related to materials that shined a light on extra-local efforts to expand the sale and use of EVs. In focus here are international reports, such as IPCC reports (IPCC, 2022a; 2022b); the IEA's annual Global EV outlook (IEA, 2023b; IEA, 2022a; IEA, 2021a); and the Renewable Energy Association's Energy Transition Readiness Index (REA, 2022). These publications shed light on recent developments in the EV sector across the globe and provided an overview of key areas such as charging infrastructure deployment, battery demand and innovation, energy consumption, and related policy developments. I also drew upon peer-reviewed scholarship focusing on extra-local developments (see: Moriarty, 2022; Foley, et al., 2020; Skjølsvold, et al., 2022; Sovacool, et al., 2022). For example, Skjølsvold, et al. (2022) shine a light on efforts to enrol local communities into the decision-making processes underlying the development of charging infrastructure in Trondheim, Norway. Others, such as Sovacool, et al. (2022), direct attention to the challenges of pursuing an EV transition in cities such as Johannesburg, Kigali, Lagos, and Nairobi because of the "…conditions of poverty and limited resources such as those facing our four urban areas (p. 12-13).” By highlighting the place-specific dynamics of the global push to electrify transportation, these reports helped me to contextualise Dublin’s shift within a wider context.

Second, I found a wide range of material relating to public and private sector developments that shaped Dublin’s turn to EVs. I engaged with the Irish government’s Climate Action Plans (Department of the Environment, Climate and Communications, 2021; Government of Ireland, 2023a); Electric Vehicle Charging Infrastructure Strategy 2022-2025 (Department of Transport, 2022); and the Dublin Local Authority Electric Vehicle Charging Strategy (Element Energy, 2022). These reports highlighted the core targets and strategies pursued by the Irish government across a variety of scales and helped to contextualise the interventions pursued by the public and private sectors. I also engaged with internal policy documents, such as decision papers published by the CRU (available at: CRU, 2018) and Irish government archives on Dáil debates, Seanad debates, and Committee debates to contextualise the major flashpoints shaping the EV shift. A key resource which I draw upon through this dissertation is the Society for the Irish Motor Industry’s database (available at: SIMI, 2023). This database provided historical data on ICE and EV registrations in Ireland. Overall, these documents and databases shed light on the workings of the Irish state and automotive sector.

The third and final set of secondary materials related to the experiences and actions of EV users. I argue that these findings shed light on what Morris (2016) might refer to as the ‘lively practices’ – the market interactions and performativities of individuals and narratives – of EV users. I drew upon secondary data from the social media and online content of EV users. A key point here, per the Chapter 6 and 7, is that EV users often use online groups to boost, support and organise around the EV project. For example, EV users discuss the latest technology and models, notify other users of broken infrastructure, and call for lobbying efforts to shape the future of the EV sector in Dublin using social media platform pages such as Irish EV owners or the Irish EV Owners Association page. These social media pages can have up to 10 posts per day. Much of these data are not publicly available but intimately related to the everyday practices that respondents engaged in. These data range from personal spreadsheets to government submissions. In sum, these secondary materials supported and shaped my overall analysis.

8.4 Reflecting on the significance and implications of the results

Taking stock of the findings, this section reflects upon the significance and implications of the research relative to my CUTS framework. The turn to EVs in Dublin, as explored in this dissertation through the lens of Critical Urban Transition Studies (CUTS), unveils a complex interplay between the state, markets, and citizens. The inadequacies, incoherent imaginaries, inconstant interventions and imaginative and iterative response that I identified in the findings reflect a wider set of power dynamics and relations that have significant implications for how geographers understand the centres of power that shape the political economy of decarbonization. I locate these centres of power within the state-market nexus.

The deep connections between the state and the market are central to the analysis, emphasizing the collaboration and tensions between the public and private sectors. My CUTS framework, per Chapter 4, helped to shine a light on the ways in which state-led urban experimentation is entrenched in an institutional and policy framework that is designed to commercialise and privatise publicly funded infrastructure. In this context, the state drives the process of fixing the infrastructure: establishing charging standards, publicly funding the network, subsidising the free to use model. However, organisations, such as the CRU, intervened on behalf of capital, by commercialising the network to "maximise the value that can be recovered from the Research and Development (R&D) expenditure made by the DUoS customer (CRU, 2017, p. 1)." This commercialization of publicly funded infrastructure introduces a distortion in the original objectives of state-led initiatives. This distortion challenges the narrative of a collaborative state-market approach, revealing the underlying tensions and contradictions inherent in the nexus. The critical lens of CUTS exposes the inherent flaws in the prevailing paradigm. It encourages a re-evaluation of the state's role in urban experimentation, urging a departure from the commodification of the decarbonizing project. As the state becomes entangled in profit-driven motives, the purported benefits of public funding and subsidization are overshadowed by the perpetuation of neoliberal ideologies that prioritize market efficiency. In essence, the commercialization of EV infrastructure underscores the need for a more profound critique of the state-market nexus and a recalibration of priorities towards a more equitable and genuinely public-driven urban transition.

At the same time, the automobility sector have no embraced sustainable practices. Despite their role in creating the climate problem in the first place; and despite the need to develop infrastructure to expand the sale of EVs; auto firms such as Volkswagen have continued to promote the sale and use of internal combustion engines while developing a type of technology (long-range batteries) that create a demand for high-speed charging. Thus, exert pressure on the existing network of chargers and users. In effect, the automobility sector have not aligned innovation with infrastructure development or wider environmental objectives; rather, they sought to pressure the state to deliver the type of infrastructure and wider conditions they need to expand the sale and use of EVs. Crucially, these processes are rooted in class dynamics across a variety of scales: they give rise to a type of infrastructure that fragments access along socio-economic lines and reinforce rounds of dispossession via the extraction of raw materials in the global south. Moving forward, then, plans to accelerate the decarbonising project, whether via an EV transition or alternative transportation models, such as developing public transportation infrastructure, necessitate a deep recalibration of the role of the state and market in delivering decarbonisation objectives. In essence, Ireland’s decarbonisation objectives require types of institutions and policies that can deliver long-term infrastructure investment and coherent strategies within a publicly owned framework that can enabled the participation and centre the needs of marginalised groups within the development and governance of the decarbonising project.

The interventions aimed at decarbonizing the city, moreover, must move beyond a conceptualization of citizens as 'end-users' and recognise the politics of difference that gives rise to diverse capabilities, risks, and vulnerabilities along socio-economic lines. By engaging marginalised groups in the co-creation of policies and initiatives, there is a greater likelihood of addressing socio-economic disparities and ensuring that the benefits of the transition are distributed more equitably. The state should act as a steward of the public interest, directing market forces towards sustainable practices, and citizens should be active participants in shaping the transition. By reconfiguring the power dynamics, the EV transition can move beyond a profit-driven, fragmented endeavour to a more holistic and inclusive process that prioritizes environmental sustainability, social equity, and the well-being of communities.

Overall, my conceptual framework has helped to shine a light on these centres of power in the political economy of Dublin's EV transition. By combining insights from the multi-level perspective, urban political ecology, and Marxian urban development, I utilised CUTS in a way that critically and effectively dissected the inadequacies, incoherent imaginaries, insufficient interventions and imaginative and iterative responses that shape the turn to EVs. The framework highlighted the intricate connections between sustainability innovations, societal structures, and nature, offering a novel understanding urban transition dynamics. A crucial point here is that while Dublin serves as a compelling case study, the results and dynamics unveiled will vary across cities in different political-economic contexts. I have unpacked the place-specific dynamics at work that give rise to Dublin's locality specific alignments. Seen in this light, geographic factors such as governance structures, economic models, and cultural nuances profoundly impact the EV transition.

In conclusion, the state-market-citizen nexus plays a pivotal role in the trajectory of EV transitions. The recalibration of roles, redistribution of power, and a collective vision for sustainability can pave the way for more effective and equitable transitions. CUTS has successfully illuminated the complexities in

Dublin's political economy, but the framework can be applied and refined for understanding and shaping EV transitions in various urban contexts. As we cities navigate this journey, collaboration, inclusivity, and a conscious reconfiguration of power dynamics are essential for fostering sustainable and impactful transitions globally. In this regard, I now turn to envision how CUTS might be imagined in future application of the framework, to enrich our understanding of the contextual and technical peculiarities of urban decarbonization projects.

8.5 Re-imagining CUTS

If oil has been the 'lifeblood' of capitalism, interweaving energy and the economy, neoliberalism and nature (Huber, 2013) – that is, if the hydrocarbon has linked the energy-transportation nexus together for nearly a century now, constituting many technical and social interlinkages with other institutions, industries, and related occupations (Freund, 1993) – my argument in this dissertation has been that a new energy regime is emerging and demands attention. As such, I drew upon scholarship engaging the multi-level perspective (MLP) on sustainability transitions, urban political ecology (UPE), and Marxian approaches to urban development to construct an original research framework, which I referred to as 'critical urban transition studies' (CUTS). I combined elements of each strand to critically analyse the urban spaces, pathways and modalities that underpin the emergence of this new energy regime. In this section, however, I consider how CUTS might be reimagined for future applications of the framework. I have four points to make.

First, and as I have demonstrated in Chapter 7, future applications of CUTS could benefit from a deeper engagement with digital geography. The digital geographies of Dublin's turn to EVs emerged as a surprising feature of my research, which led me to provide a chapter on the subject. In this regard, a 'digital turn' (see: Ash, et al., 2018) within CUTS can help to shed light on the ways in which digitally enabled infrastructures and their associated processes of datafication and mediation shape the decarbonising process. My analysis of Dublin's turn to EVs focused on the 'buggy and brittle' characteristics of digital infrastructures and shined a light on how low-carbon restructuring externalizes risks and labour onto consumers to fix the broken infrastructure they encounter. Future versions of CUTS, then, might further engage how digitality affects the power dynamics of transitions. In addition, my engagement with the digital elements of Dublin's energy transition brought to the surface the complex geographies at work. For example, I highlighted how actors driving the shift to EVs engage with online environments to socialise with, and find solutions to problems alongside, EV users from other cities. As a result, their decarbonising practices extend beyond their immediate space-times, highlighting "…a world in which proximity and distance play across one another (Allen, 2011, p. 283)." In short, a digital geography approach can help CUTS assess the chaotic and unexpected spatial dynamics of transitions.

The second point relates to the specificity of place. In the context of Dublin and given the contextual embeddedness of neoliberal restructuring projects, one crucial consideration is how developments in Dublin connect with or informs developments elsewhere. Dublin is one spot on the map of decarbonising cities. I suggest that if EV manufacturers are to succeed with their decarbonising targets, they need local economic agents to deliver the place-specific conditions needed for them to expand their accumulation prospects. Hence, firms such as ESB ecars and ChargePal navigate Dublin's challenging institutional and economic terrain to create the necessary environment for capitalist accumulation. As Harvey suggests (1982, p. 391), "location is an active moment within the overall circulation and accumulation of capital." Future iterations of the CUTS framework, therefore, must avoid one-size-fits-all narratives by providing in-depth empirical case studies of specific urban transitions and comparative investigations that can help to contrast developments across different locales.

The third point concerns the ways in which future applications of CUTS might consider a politics of difference. My CUTS approach has largely coalesced around examining the structures and dynamics of class relations in Dublin's turn to EVs. However, there are other markers of human difference such as race, gender, sexuality, and disability, that might factor into how transitions develop. A focus on the politics of difference can shed light on who is included and excluded from different stages of transition. Moreover, it can bring to the surface the ideological structures that underlie class relations and enable capitalist systems to reproduce.

Building upon the notion of a politics of difference, the fourth and final point I make relates to how future applications of CUTS might consider alternative cross-class alliances. My approach drew upon Marxist geography to examine the alliances that emerge as locally dependent economic agents intervene to defend existing or create new circulations of capital in their locality or region. Yet, other geographers such as Shin (2018; 2013) and Elwood, et al. (2015) have directed attention to different types of cross class alliances that forms out of solidarity-building between different socio-economic groups, for example, between the middle-class and working-class or migrant groups and local citizens. Seen in this light, a focus on cross-class alliances in future approaches to CUTS could look to examine the formation of cross-class alliances that provide a basis to resist orthodox formations within sustainability transitions. Moreover, a focus on such alliances might help to conceptualise a popular alternative vision to the capitalist system, which has defined the forms and frames of transition in society today.

8.6 Conclusion

The catastrophic effects of anthropogenic climate change on the earth's natural systems are beginning to emerge at an alarming rate. In response, states, firms, and individuals across the globe are seeking to expand the adoption and use of electric vehicles with a view to decarbonise. This dissertation focused on developments in Dublin's transportation sector. Overall, I conclude that the turn to EVs in Dublin produces and draws upon what I refer to as 'shallow greening', in which the interventions pursued by economic agents only begin to scratch the surface of the sort of ecological transformations needed to produce meaningful decarbonisation. Shallow greening shines a light on the ways in which the democratic potential and efficacy of sustainability innovations are limited by the political-economic context in which they are diffused and operated. As Harvey (1990, pp. 105-106) suggests, under neoliberal capitalism "…the effect of continuous innovation [...] is to devalue, if not destroy, past investments and labour skills [...] Innovation exacerbates instability, insecurity and, in the end, becomes the prime force pushing capitalism into periodic paroxysms of crisis." In the context of Dublin's turn to EVs, continuous innovation not only creates an inconstant environment in which economic agents struggle to form any unified vision of what the decarbonizing process should look like, but it also creates a type of project that prioritizes the economic order of neoliberal capitalism over decarbonization, and by extension, sacrifices the social and environmental well-being of the planet for the restoration of class power.

I have demonstrated the ways in which shallow greening emerges in the context of structural issues that bound economic agents to a 'growth first' neoliberal project. I argue this deep commitment to a market-oriented shift is not due to any faith in the dynamics of the market to provide some form of salvation; rather, economic agents are hamstrung by the decades of neoliberal development in Ireland, which constrains their capacity to envision and pursue alternatives. In other words, shallow greening reflects a wider geopolitical context defined by what Peck (2010) refers to as "zombie neoliberalism", in which the practices and politics of neoliberalization have died, but they keep stumbling on. This 'dead but dominant' form of neoliberalization has far-reaching and destructive consequences precisely because it cannot deliver a democratic or effective climate action agenda. The agents of zombie neoliberalism are intent on an apocalypse to sustain or restore class power; neoliberalism is intent on destruction. Seen in this light, society must organise around a different type of political-economic project.

I argue that, if shallow greening emerges from the forms and consequences of neoliberalization, moving towards a decarbonising project characterised by decisive and timely actions, or what I refer to as 'deep greening', requires a different set and type of interventions. Consider the interventions made during the Covid-19 pandemic, where states across the globe implemented and enforced policies that placed limits on what some might consider to be the civil liberties of individuals for the well-being of all. A project devoted to deep greening must adopt a similar approach; it must enforce restrictions over the sales and use of automobiles, and it must limit the amount of fossil fuels circulating and burnt in the energy system. In short, society must organise around and demand a politics of radical interventionism. At the same time, I argue that deep greening points to the need to pursue "…movements, subjects, and organisational forms that might realise […] revolutionary transition (Heron & Dean, 2022)." To address the climate problem and its associated economic, social, and environmental harms, society must pursue a new political-economic model. I argue that this model must be characterised by extreme wealth redistribution and by new forms of democratic control over production so that society can pursue decarbonisation outside of the restraints of profit imperatives and coercive competition. This has been the task of much of the historic struggles for alternatives to capitalism, but in the context of climate change, its message is as crucial as ever.

Bibliography

Adams-Hutcheson, G. & Longhurst, R., 2017. 'At least in person there would have been a cup of tea': interviewing via Skype. *AREA*, 49(2), pp. 148-155.

Alkousaa, R. & Wacket, M., 2023. *German transport minister 'optimistic' EU e-fuels stand-off will be resolved.* [Online] Available at: https://www.reuters.com/world/europe/germany-softens-stance-e-fuels-dispute-spiegel-2023-03-24/
[Accessed 3 August 2023].

Allen, J., 2011. Topological twists: Power's shifting geographies. *Dialogues in Human Geography,* 1(3), p. 283–298..

Allen, J., 2016. *Topologies of power.* London: Routledge.

Andersson, I. & James, L., 2018. Altruism or entrepreneurialism? The co-evolution of green place branding and policy tourism in Vaxjo, Sweden. *Urban Studies,* 55(15), pp. 3437-3453.

Andresena, S. & Agrawalab, S., 2002. Leaders, pushers and laggards in the making ofthe climate regime. *Global Environmental Change,* 12(1), p. 41–51.

Angelo, H. & Wachsmuth, D., 2014. Urbanizing Urban Political Ecology: A Critique of Methodological Cityism. *International Journal of Urban and Regional Research*, 39(1), pp. 16-27.

Arboleda, M., 2020. *Planetary Mine Territories of Extraction under Late Capitalism.* 1st ed. London & Brooklyn: Verso.

Aronoff, K., Battistoni, A., Aldana Cohen, D. & Riofrancos, T., 2019. *A Planet to Win Why We Need a New Green Deal.* London' Brooklyn: Verso.

Arora, P., 2015. Usurping Public Leisure Space for Protest: Social Activism in the Digital and Material Commons. *Space and Culture,* 18(1), pp. 55-68.

Arup & Jim Power Economics, 2022. *Reducing light fleet carbon emissions to achieve Irish Government targets,* Dublin: Society for Irish Automotive Industry.

Ash, J., Kitchin, R. & Leszczynski, A., 2018. Digital turn, digital geographies?. *Progress in Human Geography,* 42(1), pp. 25-43.

Barns, S., 2019. Negotiating the platform pivot: From participatory digital ecosystems to infrastructures of everyday life. *Geography Compass,* 13(9), p. article no: e12464.

Barns, S., 2020. The uberisation of everything. In: S. Barns, ed. *Platform urbanism*`. Singapore: Springer, pp. 79-98.

Becker, S., Moss, T. & Naumann, M., 2016. The Importance of Space: Towards a SocioMaterial and Political Geography of Energy Transitions. In: L. Gailing & T. Moss, eds. *Conceptualizing Germany's Energy Transition: Institutions, Materiality, Power, Space.* London: Palgrave Pivot, pp. 93-108.

Becker, S, Beveridge, R. & Röhring, A., 2016. Energy Transitions and Institutional Change: Between Structure and Agency. In: L. Gailing & T. Moss, eds. *Conceptualizing Germany's Energy Transition.* Brandenburg: Palgrave, pp. 21-41.

Berkeley, N., Bailey, D., Jones, A. & Jarvis, D., 2017. Assessing the transition towards Battery Electric Vehicles: A Multi-Level Perspective on drivers of, and barriers to, take up. *Transportation Research Part A Policy and Practice,* Volume 106, pp. 320-332.

Birtchnell, T. & Caletrío, J., 2013. *Elite Mobilities.* 1st ed. London: Routledge.

Blaikie, P. & Brookfield, H., 1987. *Land Degradation and Society.* 1 ed. London: Metheun.

Boyer, R., 2018. Marx's Legacy, Regulation Theory and Contemporary Capitalism. *Review of Political Economy,* 30(3), pp. 284-316.

Boyle, M., Hickson, J. & Ujhelyi Gomez, K., 2023. *Covid-19 the Case Against Neoliberalism: The United Kingdom's Political Pandemic.* London: Palgrave MacMillan.

Brady, J. & O'Mahony, M., 2011. Travel to work in Dublin. The potential impacts of electric vehicles on climate change and urban air quality. *Transportation Research Part D: Transport and Environment,* 16(2), pp. 188-193.

Braithwaite-Smith, G., 2019. *ASA rules Lexus self-charging hybrid ads 'not misleading'.* [Online]
Available at: https://www.motoringresearch.com/car-news/lexus-self-charging-hybrid-ads/
[Accessed 3 August 2023].

Breathnach, P., 2010. From Spatial Keynesianism to Post-Fordist Neoliberalism: Emerging Contradictions in the Spatiality of the Irish State. *Antipode,* 42(5), pp. 1180-1199.

Breathnach, P., 2014. Creating city-region governance structures in a dysfunctional polity: the case of Ireland's National Spatial Strategy.. *Urban Studies,* 51(11), p. 2267–2284.

Brenner, N., Peck, J. & Theodore, N., 2010. Variegated neoliberalization: geographies, modalities, pathways. *Global Networks,* 10(2), pp. 182-222.

Brenner, N. & Theodore, N., 2002. Cities and the Geographies of "Actually Existing Neoliberalism". *Antipode,* 34(3), pp. 42-68.

Bresnihan, P. & Brodie, P., 2020. New extractive frontiers in Ireland and the moebius strip of wind/data. *Environment and Planning E: Nature and Space,* 4(4), p. 1645–1664.

Bridge, G., Bouzarovski, S., Bradshaw, M. & Eyre, N., 2013. Geographies of energy transition: Space, place and the low-carbon economy. *Energy Policy,* Volume 53, pp. 331-340.

Bridge, G. & Gailing, L., 2020. New energy spaces: Towards a geographical political economy of energy transition. *Environment and Planning A: Economy and Space*, 52(6), p. 1037–1050.

Briscoe, N., 2021. *What's the state of play with Ireland's electric-vehicle charging network?.* [Online]
Available at: https://www.irishtimes.com/life-and-style/motors/what-s-the-state-of-play-with-ireland-s-electric-vehicle-charging-network-1.4642946
[Accessed 3 August 2023].

Brown, G., Kraftl, P., Pickerill, J. & Upton, C., 2012. Holding the future together: towards a theorisation of the spaces and times of transition. *Environment and Planning A*, Volume 44, pp. 1607-1623.

Bulkeley, H. & Broto, V. C., 2013. Government by experiment? Global cities and the governing of climate change. *Transactions of the Institute of British Geographers,* 23(1), pp. 92-102.

Bulkeley, H., Broto, V. C. & Maassen, A., 2014. Low-carbon Transitions and the Reconfiguration of Urban Infrastructure. *Urban Studies*, 51(7), pp. 1471-1486.

Burns, S., 2023. *Just four local authorities sign up to electric vehicle public charge point scheme.* [Online]
Available at: https://www.irishtimes.com/ireland/2023/01/17/just-four-local-authorities-sign-up-to-electric-vehicle-public-charge-point-scheme/
[Accessed 03 August 2023].

Bustos-Gallardo, B., Bridge, G. & Prieto, M., 2021. Harvesting Lithium: water, brine and the industrial dynamics of production in the Salar de Atacama. *Geoforum,* Volume 119, p. 177–189.

Butz, D. & Cook, N., 2019. Mobile methods, epistemic justice and mobility justice. In: D. Butz & N. Cook, eds. *Mobilities, Mobility Justice and Social Justice*. Oxon & New York: Routledge, pp. 81-99.

Caprotti, F., 2014. Eco-urbanism and the Eco-city, or, Denying the Right to the City?. *Antipode,* 46(5), pp. 1285-1303.

Caprotti, F., 2016. Protecting innovative niches in the green economy: investigating the rise and fall of Solyndra, 2005–2011. *GeoJournal,* Volume 82, pp. 937-955.

Caprotti, F., Chang, I. & Joss, S., 2022. Beyond the smart city: a typology of platform urbanism. *Urban Transform,* 4(4).

Carlier, M., 2022. *Global automotive manufacturing industry revenue between 2019 and 2022.* [Online]
Available at: https://www.statista.com/statistics/574151/global-automotive-industry-revenue/
[Accessed 12 December 2022].

Carrington, D., 2016. *Emissions from new diesel cars are still far higher than official limit.* [Online]
Available at: https://www.theguardian.com/environment/2016/aug/30/emissions-new-diesel-cars-far-higher-than-official-limit
[Accessed 3 August 2023].

Caulfield, B., 2022. Measuring the equity impacts of government subsidies for electric vehicles. *Energy,* Volume 248.

Chandrashekeran, S., 2016. Multidimensionality and the multilevel perspective: Territory, scale, and networks in a failed demand-side energy transition in Australia. *Environment and Planning A,* 48(8), p. 1636–1656.

Cheney-Lippold, J., 2019. *We Are Data Algorithms and the Making of Our Digital Selves.* 1st ed. New York: New York University Press.

Clark II, W. W. & Cooke, G., 2015. *The Green Industrial Revolution: Energy, Engineering and Economics.* 1st ed. Oxford; Waltham: Elsevier.

Codema, 2021. *Dublin Region Energy Master Plan,* Dublin: Codema.

Codema, 2022. *Codema about us.* [Online] Available at: https://www.codema.ie/about-us [Accessed 12 December 2022].

Dauvé, G., 2016. *Endnotes Preliminary Materials for a Balance Sheet of the 20th Century.* [Online] Available at: https://1000littlehammers.files.wordpress.com/2013/12/endnotes-1.pdf [Accessed 06 August 2022].

Confino, P., 2022. *Here are the 20 biggest automakers in the world.* [Online] Available at: https://fortune.com/2022/08/12/20-biggest-car-companies-world-fortune-global-500/ [Accessed 17 July 2023].

Cook, N., 2009. It's good to talk: performing and recording the telephone interview. *AREA,* 41(2), pp. 176-185.

Corson, C., MacDonald, K. & Neimark, B., 2013. Grabbing "Green": Markets, Environmental Governance and the Materialization of Natural Capital. *Human Geography,* 6(1), p. 1–15.

Cox, K., 2010. The Problem of Metropolitan Governance and the Politics of Scale. *Regional Studies,* 44(2), pp. 215-227.

Cox, K. & Mair, A., 1988. Locality and Community in the Politics of Local Economic Development. *Annals of the Association of American Geographers,* Volume 78, pp. 307-325.

Cox, K. & Mair, A., 1991. From Localized Social Structures to Localities as Agents. *Environment and Planning A,* Volume 23, pp. 197-213.

Cresswell, J. W., 2013. Introducing and Focusing the Study. In: J. W. Cresswell, ed. *Qualitative Inquiry and Research Design.* London: SAGE, pp. 129-143.

Cresswell, T., 2012. Mobilities II: Still. *Progress in Human Geography,* 36(5), pp. 645-653.

CRU, 2017. *ESBN Electric Vehicle Pilot & Associated Assets,* Dublin: Commission for Regulation of Utilities.

CRU, 2018. *CRU17283 Decision paper on ESBN Electric Vehicle Pilot & Associated Assets.* [Online]
Available at: https://www.cru.ie/publications/25876/
[Accessed 23 August 2023].

CSO, 2016a. *Census of Population 2016 – Profile 6 Commuting in Ireland.* [Online]
Available at: https://www.cso.ie/en/releasesandpublications/ep/p-cp6ci/p6cii/p6mtw/
[Accessed 8 August 2023].

CSO, 2016b. *8. Travel patterns,* Dublin: Central Statistics Office.

CSO, 2016c. *National Travel Survey 2016.* [Online]
Available at: https://www.cso.ie/en/releasesandpublications/ep/p-nts/nts2016/keyf/#:~:text=The%20average%20journey%20distance%20in,similar%20in%202013%20and%202014.
[Accessed 2nd August 2023].

CSO, 2020. *Earnings and Labour Costs Annual,* Dublin: Central Statistics Office.

CSO, 2022a. *Census 2022 County Press Statements.* [Online]
Available at:
https://www.cso.ie/en/census/census2022/census2022countypressstatements/
[Accessed 2nd August 2023].

CSO, 2022b. *Environmental Indicators Ireland 2022.* [Online]
Available at: https://www.cso.ie/en/releasesandpublications/ep/p-eii/environmentalindicatorsireland2022/transport/#:~:text=The%20number%20o

f%20licensed%20vehicles,to%202.9%20million%20in%202021.
[Accessed 14 August 2023].

CSO, 2023. *Census of Population 2022 - Summary Results.* [Online] Available at: https://www.cso.ie/en/releasesandpublications/ep/p-cpsr/censusofpopulation2022-summaryresults/populationchanges/
[Accessed 14 August 2023].

Cugurullo, F., 2018. Exposing smart cities and eco-cities: Frankenstein urbanism and the sustainability challenges of the experimental city. *Environment and Planning A: Economy and Space*, 50(1), pp. 73-92.

Cumbers, A., 2009. Marxism/Marxist Geography I. In: R. Kitchin & N. Thrift, eds. *International Encyclopedia of Human Geography.* s.l.:Elsevier, pp. 461-473.

Cunningham, E., 2020. *Surge in sign-ups to pay for new EV charging.* [Online] Available at: https://www.independent.ie/life/motoring/car-news/surge-in-sign-ups-to-pay-for-new-ev-charging/39443119.htmlhttps://www.independent.ie/life/motoring/car-news/surge-in-sign-ups-to-pay-for-new-ev-charging/39443119.html
[Accessed 2nd August 2023].

Dammann, F., Eichenmüller, C. & Glasze, G., 2022. Geographies of "digital governmentality": Platform-based governing through adaptive environments. *Digital Geography and Society,* Volume 3, p. 100034.

Davidson, A., 2021. Radical mobilities. *Progress in Human Geography,* 45(1), pp. 25-48.

Deegan, G., 2023. *Pre-tax profits at Irish arm of Tesla motor 75% higher.* [Online] Available at: https://www.rte.ie/news/business/2023/0417/1377384-tesla-ireland-results/
[Accessed 3 August 2023].

Delaney, K. J., 2007. Methodological Dilemmas and Opportunities in Interviewing Organizational Elites. *Sociology Compass,* 1(1), pp. 208-221.

Denzin, N. K. & Lincoln, Y. S., 2011. Introduction: The discipline and practice of qualitative research. In: *The Sage handbook of qualitative research.* Thousand Oaks, CA: SAGE, pp. 1-19.

Department of the Environment, Climate and Communications, 2021. *Climate Action Plan,* Dublin: Government of Ireland.

Department of Transport, 2022. *Electric Vehicle Charging Infrastructure Strategy 2022-2025,* Dublin: Government of Ireland.

Deutsche Welle, 2023. *Germany strikes deal with EU on combustion engine phase-out.* [Online]
Available at: https://www.dw.com/en/germany-strikes-deal-with-eu-on-combustion-engine-phase-out/a-65120095#:~:text=What%20was%20behind%20the%20dispute,for%20e%2Dfuel%20vehicle%20registration.
[Accessed 3 August 2023].

Dey, S., Caulfield, B. & Ghosh, B., 2018. Potential health and economic benefits of banning diesel traffic in Dublin, Ireland. *Journal of Transport & Health,* Volume 10, pp. 156-166.

Dicken, P., 2015. *Global Shift.* 7th ed. New York: The Guilford Press.

Ditlevsen, P. & Ditlevsen, S., 2023. Warning of a forthcoming collapse of the Atlantic meridional overturning circulation. *Nature Communications,* 14(1), p. 4254.

Dobson, J. E., 2001. Fieldwork in a Digital World. *Geographical Review,* 91(1/2), pp. 430-440.

Domhnaill, M. et al., 2022. Road traffic noise, quality of life, and mental distress among older adults: evidence from Ireland. *Cities & Health,* 6(3), p. 564–574.

Drennan, J., 2022. *€10 bn for wealthy electric car buyers.* [Online] Available at: https://www.pressreader.com/ireland/the-irish-mail-on-sunday/20220710/281663963719632
[Accessed 1 November 2022].

Driivz, 2023. *Smart EV Charging and Energy Management Software.* [Online] Available at: https://driivz.com/
[Accessed 12 April 2023].

Dublin City Council, 2019. *Dublin City Council Climate Change Action Plan,* Dublin: Dublin City Council.

Dunlap, A., 2020. Bureaucratic land grabbing for infrastructural colonization: renewable energy, L'Amassada, and resistance in southern France. *Human Geography,* 13(2), p. 109–126.

Dunlap, A. & Riquito, M., 2023. Social warfare for lithium extraction? Open-pit lithium mining, counterinsurgency tactics and enforcing green extractivism in northern Portugal. *Energy Research & Social Science,* Volume 95.

Dwyer, O., 2022. *Electric vehicle recharging infrastructure must be installed in new homes under new regulations.* [Online] Available at: https://www.thejournal.ie/public-charge-points-evs-ireland-5827399-Jul2022/
[Accessed 29 November 2022].

Ecker, Y. & Strüver, A., 2022. Towards alternative platform futures in post-pandemic cities? A case study on platformization and changing socio-spatial relations in on-demand food delivery. *Digital Geography and Society,* Volume 3, p. 100032.

EEA, 2021. *New registrations of electric vehicles in Europe. European Environmental Agency.* [Online] Available at: https://www.eea.europa.eu/ims/new-registrations-of-electric-vehicles#:~:text=The%20recently%20proposed%20legislation%20(Fit,needed%

20to%20achieve%20these%20goals.
[Accessed 31 Janaury 2022].

Egan, K., 2021. *Car dealers importing vehicles from Japan post-Brexit.* [Online] Available at: https://www.rte.ie/news/2021/0720/1236230-import-cars-brexit/ [Accessed 3 August 2023].

Ekers, M. & Prudham, S., 2015. Towards the socio-ecological fix. *Environment and Planning A*, Volume 47, pp. 2438-2445.

Element Energy, 2022. *Dublin Local Authority Electric Vehicle Charging Strategy,* Dublin: Element Energy.

Ellerbeck, S., 2023. *The Horn of Africa is facing an unprecedented drought. What is the world doing to help solve it?.* [Online] Available at: weforum.org/agenda/2022/07/africa-drought-food-insecurity-starvation-somalia/
[Accessed 8 August 2023].

Elmhirst, R., 2011. Introducing new feminist political ecologies. *Geoforum,* 42(2), pp. 129-132.

Elwood, S., Lawson, V. & Nowak, S., 2015. Middle-Class Poverty Politics: Making Place, Making People. *Annals Of The Association Of American Geographers,* 105(1), pp. 123-143.

Elwood, S. & Leszczynski, A., 2011. Privacy, Reconsidered: New Representations, Data Practices, and The Geoweb. *Geoforum,* 42(1), p. 6–15.

Ernst & Young, 2022. *How will Europe compete for investment amid ongoing turbulence?,* [online]: Ernst and Young.

ESB ecars, 2022. *Changes to our public charging prices in Ireland.* [Online] Available at: https://esb.ie/media-centre-news/blog/article/ecars-news/2022/04/04/changes-to-our-public-charging-prices-in-ireland
[Accessed 2nd August 2023].

ESB Networks, 2018a. *Electric Vehicle Charging Infrastructure Project Close Down Report*, Dublin: ESB Networks.

ESB Networks, 2018b. *Preparing for Electric Vehicles on the Irish Distribution System Pilot Project Report Summary,* Dublin: ESB Networks.

European Commission, 2022. *Commission proposes new Euro 7 standards to reduce pollutant emissions from vehicles and improve air quality*. [Online] Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6495 [Accessed 08 December 2022].

European Council and Council of the European Union, 2022. *Fit for 55.* [Online] Available at: https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/
[Accessed 08 December 2022].

Eurostat, 2019. *Gross domestic product (GDP) at current market prices by metropolitan regions.* [Online]
Available at:
https://ec.europa.eu/eurostat/databrowser/view/met_10r_3gdp/default/table?lang=en
[Accessed 28 September 2022].

Evans, J., Karvonen, A. & Raven, R., 2016. The Experimental City: New modes and prospects of urban transformation. In: J. Evans, A. Karvonen & R. Raven, eds. *The Experimental City.* New York: Routledge, pp. 1-13.

Evans, R. & Marvin, S., 2006. Researching the sustainable city: three modes of interdisciplinarity. *Environment and Planning A,* 38(6), pp. 1009-1028.

Ewing, J., 2023. *Tesla May Have Already Won the Charging Wars.* [Online] Available at: https://www.nytimes.com/2023/06/27/business/energy-environment/tesla-gm-ford-charging-electric-vehicles.html
[Accessed 3 August 2023].

Ewing, J. & Krauss, C., 2023. *Falling Lithium Prices Are Making Electric Cars More Affordable.* [Online] Available at: https://www.nytimes.com/2023/03/20/business/lithium-prices-falling-electric-vehicles.html
[Accessed 2nd August 2023].

Featherstone, M., Thrift, N. & Urry, J., 2005. *Automobilities.* 1st ed. London; California, Thousand Oaks; New Delhi: SAGE Publications Ltd.

Federal Ministry for Economic Affairs and Climate Action, 2023. *Frequently asked questions (FAQs) about the purchase grant for electric vehicles.* [Online] Available at: https://www.bmwk.de/Redaktion/EN/FAQ/Electric-Mobility/faqs-purchase-grant-for-electric-vehicles.html
[Accessed 14 August 2023].

Fields, D., Bissell, David & Macrorie, R., 2020. Platform methods: studying platform urbanism outside the black box. *Urban Geography,* 41(03), pp. 462-468.

Flick, C., 2016. Informed Consent and the Facebook Emotional Manipulation Study. *Research Ethics,* 12(1), pp. 14-28.

Foley, B., Kenan, D. & Tan, Y., 2020. Factors Affecting Electric Vehicle Uptake: Insights from a Descriptive Analysis in Australia. *Urban Science,* 4(57).

Foucault, M., 1989. *The Order of Things.* New York: Routledge.

Fox-Rogers, L. & Murphy, E., 2014. Informal strategies of power in the local planning system. *Planning Theory,* 13(3), p. 244–268.

Fox-Rogers, L. & Murphy, E., 2015. From brown envelopes to community benefits: The co-option of planning gain agreements under deepening neoliberalism. *Geoforum,* Volume 67, pp. 41-50.

Fraser, A., Murphy, E. & Kelly, S., 2013. Deepening Neoliberalism via Austerity and ‘Reform’: The Case of Ireland. *Human Geography,* 6(2), p. 38–53.

Freund, P., 1993. *The Ecology of the Automobile.* 1st ed. Montreal and New York: Black Rose Books .

Gaffney, F., Deane, J. & Ó Gallachóir, B., 2017. A 100 year review of electricity policy in Ireland (1916–2015). *Energy Policy*, Volume 105, pp. 67-79.

Gailing, L. & Moss, T., 2016. *Conceptualizing Germany's Energy Transition.* 1st ed. London: Palgrave .

Gardiner, B., 2019. *Dirty lies: how the car industry hid the truth about diesel emissions.* [Online]
Available at: https://www.theguardian.com/environment/2019/mar/22/dirty-lies-how-the-car-industry-hid-the-truth-about-diesel-emissions
[Accessed 3 August 2023].

Geels, F. W., 2005. Co-evolution of technology and society: The transition in water supply and personal hygiene in the Netherlands (1850–1930)—a case study in multi-level perspective. *Technology in Society* , 27(3), p. 363–397.

Geels, F. W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1(1), pp. 24-40.

Geels, F. W., Kemp, R., Dudley, G. & Lyons, G., 2013. *Automobility in Transition?.* 1st ed. Abingdon: Routledge.

Geels, F. W., 2012. A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies. *Journal of Transport Geography*, Volume 24, pp. 471-482.

Geels, F. W., 2014. Regime Resistance Regime Resistance against Low-Carbon Transitions: Introducing Politics and Power into the Multi-Level Perspective. *Theory, Culture & Society*, 31(5), pp. 21-40.

Geels, F. W., 2019. Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. *Current Opinion in Environmental Sustainability,* Volume 39, pp. 187-201.

Geels, F. W., Hekkert, M. P. & Jacobsson, S., 2008. The dynamics of sustainable innovation journeys. *Technology Analysis & Strategic Management,* 20(5), pp. 521-536.

Geels, F. W., Sovacool, B. K., Schwanen, T. & Sorrell, S., 2017. The Socio-Technical Dynamics of Low-Carbon Transitions. *Joule*, 1(3), p. 463–479.

Gilroy, P., 2001. Driving While Black. In: D. Miller, ed. *Car Cultures.* Oxford: Berg Publishers, pp. 81-105.

Goldstein, K., 2002. Getting in the door: Sampling and completing elite interviews. *Political Science and Politics*, 35(4), p. 669– 672..

Gorman, S., 2022. *ESB announce 50% electric vehicle charging price hike.* [Online]
Available at: https://www.irishexaminer.com/news/arid-41015243.html
[Accessed 2nd August 2023].

Gossling, S. & Stavrinidi, I., 2016. Social Networking, Mobilities, and the Rise of Liquid Identities. *Mobilities,* 11(5), pp. 723-743.

gov.ie, 2023. *Shared Island Sports Club EV Charging Scheme opens today.* [Online]
Available at: https://www.gov.ie/en/press-release/6a048-shared-island-sports-club-ev-charging-scheme-opens-today/
[Accessed 3 August 2023].

Government of Ireland, 2022. *National Energy Security Framework,* Dublin: Prepared by the Department of the Environment, Climate & Communications.

Government of Ireland, 2023. *Climate Action Plan 2023 CAP23,* Dublin: Government of Ireland.

Government of Ireland, 2023. *gov.ie - Zero Emission Vehicles Ireland.* [Online] Available at: https://www.gov.ie/en/campaigns/18b95-zero-emission-vehicles-ireland/
[Accessed 1st August 2023].

Graham, M., 2020. Regulate, replicate, and resist - the conjunctural geographies of platform urbanism. *Urban Geography,* 41(3), pp. 453-457.

Graham, M. et al., 2020. The Fairwork Foundation: Strategies for improving platform work in a global context. *Geoforum,* Volume 112, pp. 100-103.

Graham, S. & Marvin, S., 2001. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition.* 1st ed. London; New York: Routledge.

Graham, S. & Thrift, N., 2007. Out of Order: Understanding Repair and Maintenance. *Theory, Culture & Society,* 24(3), pp. 1-25.

Haarstad, H., Kjærås, K., Røe, P. G. & Tveiten, K., 2023. Diversifying the compact city: A renewed agenda for geographical research. *Dialogues in Human Geography*, 13(1), p. 5–24.

Hannan, M. A. et al., 2018. A Review of Internet of Energy Based Building Energy Management Systems: Issues and Recommendations. *IEEE access,* Volume 6, pp. 38997-39014.

Hanna, P., 2012. Using internet technologies (such as Skype) as a research medium: a research note. *Qualitative research,* 12(2), pp. 239-242.

Harlan, T., 2021. Green development or greenwashing? A political ecology perspective on China's green beltand road. *Eurasian Geography and Economics,* 62(2), pp. 202-226.

Harris, J. L., 2020. Emerging clusters: the importance of legitmacy, path advocates, and narratives. *European Planning Studies.*

Harrowell, E., Davies, T. & Disney, T., 2018. Making Space for Failure in Geographic Research. *The Professional Geographer*, 70(2), pp. 230-238.

Harvey, D., 1982. *The Limits to Capital.* Oxford: Blackwell Publishers.

Harvey, D., 1985a. The Geopolitics of Capitalism. In: D. Gregory & J. Urry, eds. *Social Relations and Spatial Structures.* London: Macmillan, pp. 128-63.

Harvey, D., 1985b. *The Urbanization of Capital.* 1st ed. Oxford: Basil Blackwell.

Harvey, D., 1989. From Managerialism to Entrepreneurialism: The Transformation in Urban Governance in Late Capitalism. *Geografiska Annaler: Series B, Human Geography,* 71(1), pp. 3-17.

Harvey, D., 1990. *The Condition of Postmodernity.* 1st ed. Cambridge: Blackwell Publisher.

Harvey, D., 1993. The Nature of Environment: Dialectics of Social and Environmental Change. *Socialist Reigster,* Volume 29, pp. 1-51.

Harvey, D., 2001. *Spaces of Capital: Toward a Critical Geography.* 1st ed. Edinburgh: Edinburgh University Press.

Harvey, D., 2005. *A brief history of neoliberalism.* 1st ed. Oxford: Oxford University Press.

Harvey, D., 2010. *A Companion to Marx's Capital.* 1st ed. London; New York: Verso.

Harvey, D., 2013. *"Capitalism Never Solves Its Crisis Problems; It Moves Them Around Geographically".* [Online] Available at: https://truthout.org/video/capitalism-never-solves-its-crisis-problems-it-moves-them-around-geographically/
[Accessed 3 August 2023].

Harvey, D., 2014. *Seventeen Contradictions and the End of Capitalism.* Oxford: Oxford University Press..

Harvey, D. & Roberts, M., 2018. *Marx's law of value: a debate between David Harvey and Michael Roberts.* [Online] Available at: https://thenextrecession.wordpress.com/2018/04/02/marxs-law-of-value-a-debate-between-david-harvey-and-michael-roberts/
[Accessed 17 January 2021].

Hearne, R., 2014. Actually Existing Neoliberalism: Public-Private Partnerships in Public Service and Infrastructure Provision in Ireland. In: MacLaren, Andrew & S. Kelly, eds. *Neoliberal Urban Policy and the Transformation of the City : Reshaping Dublin.* London: Palgrave MacMillan, pp. 157-173.

Heffron, R. J. & McCauley, D., 2018. What is the 'Just Transition'?. *Geoforum,* Volume 88, pp. 74-77.

Henderson, J., 2020. EVs Are Not the Answer: A Mobility Justice Critique of Electric Vehicle Transitions. *Annals of the American Association of Geographers,* 110(6), pp. 1993-2010.

Hermans, F., Van Apeldoorn, D., Stuiver, M. & Kasper, K., 2013. Niches and networks: Explaining network evolution through niche formation processes. *Research Policy,* 42(3), pp. 613-623.

Heron, K. & Dean, J., 2022. *Climate Leninism and Revolutionary Transition: Organization and Anti-Imperialism in Catastrophic Times.* [Online] Available at: https://spectrejournal.com/climate-leninism-and-revolutionary-transition/
[Accessed 18 July 2022].

Heynen, N., 2014. Urban political ecology I: The urban century. *Progress in Human Geography,* 38(4), pp. 598-604.

Hilliard, M., 2018. *Electric vehicle drivers to pay for charging; ESB says revenue raised will go towards providing a network improvements.* [Online] Available at: advance-lexis-

com.may.idm.oclc.org/api/document?collection=news&id=urn:con
[Accessed 06 June 2023].

Hitchings, R. & Latham, A., 2019. Qualitative methods I: On current conventions in interview research.. *Progress in Human Geography,* 44(2), pp. 389-398.

Hodson, M. & Marvin, S., 2010. Urbanism in the anthropocene: Ecological urbanism or premium ecological enclaves?. *City,* 14(3), pp. 298-313.

Hölsgens, R., 2021. Introducing the adopter perspective in social innovation research. *Innovation: The European Journal of Social Science Research.*

Holt, A., 2010. Using telephones for narrative interviewing: a research note. *Qualitative Research,* 10(1), p. 113–121.

Huber, M., 2021. The case for socialist modernism. *Political Geography* , Volume 87, p. 102352.

Huber, M. T., 2013. *Lifeblood Oil, Freedom and the Forces of Capital.* 1st ed. Minnesota: Quadrant.

IEA, 2018. *The Future of Petrochemicals Towards more sustainable plastics and fertilisers,* Paris: IEA; OECD.

IEA, 2021a. *Global EV Outlook 2021 Accelerating ambitions despite the pandemic,* Paris: International Energy Agency.

IEA, 2021b. *Ten years of clean energy start-ups,* Paris: IEA.

IEA, 2022a. *Global EV Outlook 2022 Securing supplies for an electric future,* Paris: International Energy Agency.

IEA, 2022b. *Global Supply Chain of Batteries,* Paris: IEA.

IEA, 2023a. *Renewable Energy Market Update Outlook for 2023 and 2024,* Paris: International Energy Agency.

IEA, 2023b. *Global EV Outlook 2023,* Paris: International Energy Agency.

IEA, 2023c. *World Energy Investment 2023,* Paris: International Energy Agency.

IEVOA, 2016. *Irish Electric Vehicles Owners Association (IEVOA) Submission to the CER on the ESBN Electric Vehicle Pilot and Associated Assets Consultation.* [Online]
Available at: https://www.crf.ie/wp-content/uploads/2017/10/CRU17283-16-IEVOA-Response.pdf
[Accessed 27 January 2023].

IEVOA, 2023a. *irishevowners.ie: corporate membership.* [Online]
Available at: https://www.irishevowners.ie/corporate-membership/
[Accessed 27 January 2023].

IEVOA, 2023b. *https://www.irishevowners.ie/resources/etiquette/.* [Online]
Available at: https://www.irishevowners.ie/resources/etiquette/
[Accessed 27 January 2023].

IPCC, 2022a. *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change,* Cambridge: Cambridge University Press.

IPCC, 2022b. *Urban systems and other settlements,* Cambridge; New York: Intergovernmental Panel on Climate Change..

IPRA, 2021. *IPRA Forecourt and Retail News.* [Online]
Available at: https://ipra.ie/wp-content/uploads/2021/04/FN-April2021low-res.pdf
[Accessed 27 January 2023].

Islamic Relief, 2022. *Pakistan Monsoon Floods 2022,* Birmingham: Islamic Relief Pakistan.

Jerez, B., Garcés, I. & Torres, R., 2021. Lithium extractivism and water injustices in the Salar de Atacama, Chile: The colonial shadow of green electromobility. *Political Geography,* Volume 87, p. 102382.

Jessop, B., 2002. Liberalism, neoliberalism, and urban governance: A state-theoretical perspective. *Antipode,* 34(3), p. 452.

Jessop, B., 2006. Spatial Fixes, Temporal Fixes and Spatio- Temporal Fixes. In: N. Castree & D. Gregory, eds. *David Harvey: A Critical Reader.* Malden, MA; Oxford; Carlton, Victoria: Blackwell Publishing, pp. 142-167.

Jessop, B., 2008. *State Power.* 1st ed. Cambirdge: Polity Press.

Jessop, B., 2009. The spatiotemporal dynamics of capital and its globalization and their impact on state power and democracy. In: H. Rosa & W. Scheuerman, eds. *High–Speed Society: Social Acceleration, Power, and Modernity.* University Park: : Penn State University Press, pp. 135-158.

Jin, F., Yao, E. & An, K., 2020. Analysis of the potential demand for battery electric vehicle sharing: Mode share and spatiotemporal distribution. *Journal of Transport Geography,* Volume 82, pp. 1-12.

Jonas, A. E. G., Gibbs, D. & While, A., 2011. The New Urban Politics as a Politics of Carbon Control. *Urban Studies,* 48(12), pp. 2537-2554.

Jones, C., 2019. Capital, Neoliberalism and Educational Technology. *Postdigital Science and Education,* Volume 1, p. 288–292.

Jupp, E., 2020. *Norway finds Lexus 'self-charging hybrid' adverts misleading.* [Online]
Available at: https://www.motoringresearch.com/car-news/norway-finds-lexus-self-charging-hybrid-adverts-misleading/
[Accessed 03# August 2023].

Kallianos, Y., Dunlap, A. & Dalakoglou, D., 2022. Introducing infrastructural harm: rethinking moral entanglements, spatio-temporal dynamics, and resistance(s). *Globalizations.*

Kane, M., 2021. *Volkswagen Group Nearly Doubled Global BEV Sales In 2021.* [Online]
Available at: https://insideevs.com/news/560278/volkswagen-group-sales-2021/
[Accessed 3 August 2023].

Karnøe, P. & Garud, R., 2011. Path Creation: Co-creation of Heterogeneous Resources in the Emergence of the Danish Wind Turbine Cluster. *European Planning Studies,* 20(5), pp. 733-752.

Katz, C., 2017. Revisiting minor theory. *Environment and Planning D: Society andSpace,* 35(4), p. 596–599.

Kaufmann, V., Bergman, M. M. & Joye, D., 2004. Motility: Mobility as Capital. *International Journal of Urban and Regional Research,* 28(4), pp. 745 - 756.

Keil, R., 2003. Urban Political Ecology. *Urban Geography,* 24(8), p. 723–738.

Keil, R., 2007. Sustaining modernity, modernizing nature: the environmental crisis and the survival of capitalism. In: R. Krueger & D. Gibbs, eds. *The sustainable development paradox.* New York: The Guilford Press, pp. 41-66.

Keil, R., 2009. The urban politics of roll-with-it neoliberalization. *City,* 13(2-3), pp. 230-245.

Kester, J., 2018. Governing electric vehicles: mobilizing electricity to secure automobility. *Mobilities,* 13(2), pp. 200-215.

Kitchin, R., 2011. The Programmable City. *Environment and Planning B: Planning and Design,* Volume 38, pp. 945-951.

Kitchin, R., 2014. The real-time city? Big data and smart urbanism. *GeoJournal,* Volume 79, pp. 1-14.

Kitchin, R., 2019. Governance. In: *Digital Geographies.* London: SAGE Publications Ltd, p. 238.

Kitchin, R. & Dodge, M., 2011. *Code/Space: Software and Everyday Life.* Cambridge: MIT Press.

Kitchin, R. & Fraser, A., 2020. *Slow computing why we need balanced digital lives.* 1st ed. Bristol: Bristol University Press.

Kitchin, R. et al., 2012. Placing neoliberalism: the rise and fall of Ireland's Celtic Tiger. *Envrionment and Planning A Economy and Space,* 44(6), pp. 1302-1326.

Kivimaaa, P. & Kern, F., 2016. Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Research policy,* Volume 45, pp. 205-217.

Kloppenburg, S. & Boekelo, M., 2019. Digital platforms and the future of energy provisioning: Promises and perils for the next phase of the energy transition. *Energy Research & Social Science,* Volume 49, pp. 68-73.

Knobloch, F. et al., 2020. Net emission reductions from electric cars and heat pumps in 59 world regions over time. *Nature Sustainability,* 3(6), pp. 437-447.

Kogler, D., 2019. *Evolutionary Economic Geography Theoretical and Empirical Progress.* 1st ed. London: Routledge.

Kuby, M., 2019. The opposite of ubiquitous: How early adopters of fast-filling alt-fuel vehicles adapt to the sparsity of stations. *Journal of Transport Geography,* Volume 75, pp. 46-57.

Latour, B., 2005. *Reassembling the Social An Introduction to Actor-Network Theory.* 1st ed. New York & Oxford: Oxford University Press.

Lauermann, J., 2018. Municipal statecraft: Revisiting the geographies of the entrepreneurial city. *Progress in Human Geography,* 42(2), pp. 205-224.

Lawhon, M. & Murphy, J. T., 2012. Socio-technical regimes and sustainability transitions: Insights from political ecology. *Progress in Human Geography*, 36(3), pp. 354-378.

Lawton, P. & Punch, M., 2014. Urban Governance and the 'European City': Ideals and Realities in Dublin, Ireland. *International Journal of Urban and Regional Research*, 38(3), p. 864–85.

Lee, G., 2021. *ESB unveils most powerful electric car charging facility yet.* [Online]
Available at: https://www.rte.ie/news/ireland/2021/0707/1233714-electric-cars/
[Accessed 2nd August 2023].

Leszczynski, A., 2018. Spatialities. In: J. Ash, R. Kitchin & A. Leszczynski, eds. *Digital Geographies.* London: SAGE, pp. 13-23.

Leszczynski, A., 2020. Glitchy vignettes of platform urbanism. *Environment and Planning D: Society and Space,* 38(2), pp. 189-208.

Leszczynski, A. & Elwood, S., 2022. Glitch epistemologies for computational cities. *Dialogues in Human Geography*, 12(3), pp. 361-378.

Lienart, P., 2022. *A Reuters analysis of 37 global automakers found that they plan to invest nearly $1.2 trillion in electric vehicles and batteries through 2030.* [Online]
Available at: https://graphics.reuters.com/AUTOS-INVESTMENT/ELECTRIC/akpeqgzqypr/index.html
[Accessed 29 November 2022].

Lima, V., Hearne, R. & Murphy, M., 2022. Housing financialisation and the creation of homelessness in Ireland. *Housing studies.*

Line, T., Jain, J. & Lyons, G., 2011. The role of ICTs in everyday mobile lives. *Journal of Transport Geography,* 19(6), pp. 1490-1499.

Lin, X. & Sovacool, B. K., 2020. Inter-niche competition on ice? Socio-technical drivers, benefits and barriers of the electric vehicle transition in Iceland. *Environmental Innovation and Societal Transitions,* Volume 35, pp. 1-20.

Lipietz, A., 1996. Geography, Ecology, Democracy. *Antipode,* 28(3), pp. 219-228.

Longhurst, R., 2020. Thinking about research, space, Skype and swamps. *Gender, Place & Culture,* 27(5), pp. 695-703.

Lopolito, A., Morone, P. & Sisto, R., 2011. Innovation niches and socio-technical transition: A case study of bio-refinery production. *Futures,* 43(1), pp. 27-38.

Lynch, M. & Mah, C., 2018. Using internet data sources to achieve qualitative interviewing purposes: a research note. *Qualitative Research,* 18(6), pp. 741-752.

MacDonald, K. I., 2013. Grabbing 'Green': Cynical Reason, Instrumental Ethics and the Production of 'the Green Economy. *Human Geography,* 6(1), p. 46–63.

MacKinnon, D., Dawley, S., Pike, A. & Cumbers, A., 2019. Rethinking Path Creation: A Geographical Political Economy Approach. *Economic Geography,* 95(2), pp. 113-135.

Mahmud, K., Town, G., Morsalin, S. & Hossain, M., 2018. Integration of electric vehicles and management in the internet of energy. *Renewable & sustainable energy reviews,* Volume 82, pp. 4179-4203.

Malm, A., 2020. *Corona, Climate, Chronic Emergency War Communism in the Twenty-First Century.* 1st ed. London: Verso.

Malm, A., 2021. *How to Blow Up a Pipeline.* 1st ed. London: Verso.

Markard, J., Raven, R. & Truffer, B., 2012. Sustainability transitions: An emeging field of research and it's prospects. Special edition on sustainability transitions.. *Research Policy,* 41(6), pp. 955-967.

Marx, K., [1867] 1976. *Capital. Vol 1.* 1st ed. London: Penguin books.

Marx, K. & Engels, F., 1998 [1845]. Volume I: Critique of Modern German Philopsophy According to Its representative Feuerbach. In: *The German Ideology.* New York: Promotheus Books, pp. 27-479.

Mashhoodi, B. & van der Blij, N., 2021. Drivers' range anxiety and cost of new EV chargers in Amsterdam: a scenario-based optimization approach. *Annals of GIS,* 27(1), pp. 87-98.

Mason, J., 2002. *Qualitative Researching.* 2nd ed. London: SAGE.

Massey, D., 1994. *Space, Place and Gender.* 1st ed. Minneapolis: Polity Press; University of Minnesota Press.

Massey, D., 2005. *For Space.* 1st ed. London: SAGE.

Maxwell, J., 2009. Designing a Qualitative Study. In: B. &. D. Rog, ed. *Qualitative research.* New York: Sage, pp. 235-249.

McCann, E. & Ward, K., 2012. Assembling urbanism: following policies and 'studying through' the sites and situations of policy making. *ENVIRONMENT AND PLANNING A-ECONOMY AND SPACE,* 44(1), pp. 42-51.

McCarthy, J., 2015. A socioecological fix to capitalist crisis and climate change? The possibilities and limits of renewable energy. *Environment and Planning A: Economy and Space,* 47(12), p. 2485–2502.

McDonnell, S. & Caulfield, B., 2011. Measuring the Failure of Planning and Its Impact on Sustainable Travel in Dublin, Ireland. *Energies,* 5(5), pp. 727-740.

McDowell, L., 2003. *Redundant Masculinities?: Employment Change and White Working Class Youth.* 1st ed. Oxford: Blackwell.

McFarlane, C. & Anderson, B., 2011. Thinking with Assemblage. *Area,* 43(2), pp. 162-164.

McKitrick, M., Schuurman, N. & Crooks, V., 2022. Collecting, analyzing, and visualizing location-based social media data: review of methods in GIS-social media analysis. *Geojournal.*

Meek, D., 2012. YouTube and Social Movements: A Phenomenological Analysis of Participation, Events and Cyberplace. *Antipode,* 44(4), pp. 1429-1448.

Mercille, J. & Murphy, E., 2019. Market, Non-Market and Anti-Market Processes in Neoliberalism. *Critical Sociology,* 45(7-8), pp. 1093-1109.

Mikecz, R., 2012. Interviewing Elites: Addressing Methodological Issues. *Qualitative Inquiry,* 18(6), pp. 482-493.

Miles, W. B., 2021. The invisible commodity: Local experiences with forest carbon offsetting in Indonesia. *Environment and Planning E: Nature and Space,* 4(2), pp. 499-524.

Mitchell, T., 2011. *Carbon Democracy Political Power in the Age Oil.* 1st ed. London & New York: Verso.

Moore-Cherry, N., 2020 . Urban redevelopment, governance and vulnerability: thirty years of 'regeneration' in Dublin. *Boletín de la Asociación de Geógrafos Españoles,* 87(11).

Moore-Cherry, N. & Tomaney, J., 2018. Spatial planning, metropolitan governance and territorial politics in Europe: Dublin as a case of metro-phobia?. *European Urban and Regional Studies,* 26(4), p. 365–381.

Moriarty, P., 2022. Electric vehicles can have only a minor role in reducing transport’s energy and environmental challenges. *AIMS Energy,* 10(1), p. 131–148.

Morozov, E., 2013. *To save everything, click here.* 1st ed. New York: PublicAffairs; the Perseus Books Group.

Morris, J. H., 2016. The performativity, performance and lively practices in financial stability press conferences. *Journal of Cultural Economy,* 9(3), pp. 245-260.

Nader, L., 1972. *Up the Anthropologist: Perspectives Gained From Studying Up.* [Online]
Available at: https://files.eric.ed.gov/fulltext/ED065375.pdf
[Accessed 27 January 2022].

Nagata, K., 2022. *Collapsing pyramid: EV shift strikes at heart of Japan's auto sector.* [Online]
Available at: https://www.japantimes.co.jp/news/2022/11/07/business/ev-shift-japan-auto-industry/
[Accessed 3 August 2023].

Neumann, R., 2009. Political Ecology. In: R. Kitchin & N. Thrift, eds. *International Encyclopedia of Human Geography.* Elsevier: London, pp. 228-233.

Newell, P. & Mulvaney, D., 2013. The political economy of the "just transition'. *Geographical Journal,* 179(2), pp. 132-140.

Nissan, 2012. *2012 Nissan LEAF Press Kit.* [Online]
Available at: https://usa.nissannews.com/en-US/releases/release-3b65d33e214f4458ba230be9c0977e43-US-2012-nissan-leaf-press-kit
[Accessed 29 June 2023].

Nissan, 2023. *Nissan Leaf - Features.* [Online]
Available at: https://cabracars.nissan.ie/vehicle/leaf/features
[Accessed 23 August 2023].

NOAA, 2023. *Antarctic sea ice reaches an early winter record low in June 2023.* [Online]
Available at: https://www.climate.gov/news-features/event-tracker/antarctic-sea-ice-reaches-early-winter-record-low-june-2023
[Accessed 14 August 2023].

Nost, E. & Colven, E., 2022. Earth for AI: A Political Ecology of Data-Driven Climate Initiatives. *Geoforum,* Volume 130, pp. 23-34.

NRDC, 2019. *Want a Healthy Planet? Put Energy Efficiency to Work!.* [Online] Available at: https://www.nrdc.org/experts/lauren-urbanek/want-healthy-planet-put-energy-efficiency-work
[Accessed 26 September 2022].

Ó Maonaigh, C., 2023. Cross-class alliances and the rise of electric vehicles in Dublin. *Human Geography,* 0(0).

O'Brien, C., 2019. *ESB introduces charges for its fast electric car chargers.* [Online]
Available at: https://www.irishtimes.com/business/transport-and-tourism/esb-introduces-charges-for-its-fast-electric-car-chargers-1.4060081
[Accessed 2nd August 2023].

O'Doherty, C., 2021. *'It's a farcical situation' – wealthy drivers using €5,000 State electric vehicle grants to buy Teslas and Porsches.* [Online] Available at: https://www.independent.ie/irish-news/its-a-farcical-situation-wealthy-drivers-using-5000-state-electric-vehicle-grants-to-buy-teslas-and-porsches/40116308.html#:~:text=Irish%20News-,'It's%20a%20farcical%20situation'%20%E2%80%93%20wealthy%20drivers%20usin
[Accessed 23 August 2023].

O'Donoghue, P., 2023. *Ireland's electric car targets 'unrealistic' with charging point shortage.* [Online]
Available at: https://www.thetimes.co.uk/article/irelands-electric-car-targets-unrealistic-with-charging-point-shortage-v89mf8j7c
[Accessed 3rd August 2023].

OECD, 2022. *Redesigning Ireland's Transport for Net Zero,* Dublin: OECD.

Oireachtas , 2015. *Joint Committee on Transport and Communications debate - Wednesday, 18 Nov 2015 - Electric Vehicles: Discussion with Irish EV Owners Association.* [Online]
Available at: Wednesday, 18 Nov 2015
[Accessed 27 January 2023].

Oireachtas, 1925. *Local Government Act, 1925,* Dublin: Office of the Attorney General.

Oireachtas, 2009a. *Financial Resolution No. 11: General (Resumed).*. [Online]
Available at:
https://www.oireachtas.ie/en/search/?q=%22electric%20vehicle%22%20%26%22nissan%22&sort=date&debateType=all&searchType=debates&datePeriod=all
[Accessed 02 August 2023].

Oireachtas, 2009b. *Electric Vehicles.*. [Online]
Available at: https://www.oireachtas.ie/en/search/?q=%22test-bed%2C%20particularly%20in%20relation%20to%20network%20infrastructure%20development%22&sort=relevance&originalFilter=%2Fen%2Fdebates%2Ffind%2F%3FdatePeriod%3Dall%26debateType%3Ddail%26resultsPerPage%3D50&deba
[Accessed 2nd August 2023].

Oireachtas, 2009c. *Dáil Éireann debate - Tuesday, 28 Apr 2009.* [Online]
Available at: https://www.oireachtas.ie/en/debates/debate/dail/2009-04-28/46/?highlight%5B0%5D=memorandum&highlight%5B1%5D=understanding&highlight%5B2%5D=memorandum&highlight%5B3%5D=understanding&highlight%5B4%5D=memorandum&highlight%5B5%5D=understanding&highlight%5B6%
[Accessed 12 April 2023].

Oireachtas, 2009d. *Dáil Éireann debate - Tuesday, 10 Feb 2009.* [Online]
Available at: https://www.oireachtas.ie/en/debates/debate/dail/2009-02-10/27/?highlight%5B0%5D=electric&highlight%5B1%5D=vehicles&highlight

%5B2%5D=electric&highlight%5B3%5D=vehicles&highlight%5B4%5D=vehicles&highlight%5B5%5D=electric&highlight%5B6%5D=vehicles&highlight
[Accessed 2nd August 2023].

Oireachtas, 2020. *Dáil Éireann debate - Tuesday, 22 Sep 2020.* [Online] Available at: https://www.oireachtas.ie/en/debates/debate/dail/2020-09-22/49/?highlight%5B0%5D=public&highlight%5B1%5D=charge&highlight%5B2%5D=point&highlight%5B3%5D=scheme#s51
[Accessed 2 August 2023].

Oireachtas, 2021a. *Climate Action and Low Carbon Development (Amendment) Act 2021.* [Online] Available at: https://www.irishstatutebook.ie/eli/2021/act/32/enacted/en/html
[Accessed 08 December 2022].

Oireachtas, 2021b. *Joint Committee on Environment and Climate Action debate - Reduction of Carbon Emissions of 51% by 2030: Discussion (Resumed).* [Online] Available at: https://www.oireachtas.ie/en/debates/debate/joint_committee_on_environment_and_climate_action/2021-07-13/2/?highlight%5B0%5D=transition&highlight%5B1%5D=evs&highlight%5B2%5D=should&highlight%5B3%5D=also&highlight%5B4%5D=seen&highlight%5B5%5D=broader&highl
[Accessed 12 April 2023].

Oireachtas, 2023. *Joint Committee on Environment and Climate Action debate - Thursday, 16 Feb 2023.* [Online] Available at: https://www.oireachtas.ie/en/debates/debate/joint_committee_on_environment_and_climate_action/2023-02-16/2/?highlight%5B0%5D=local&highlight%5B1%5D=authority&highlight%5B2%5D=really&highlight%5B3%5D=wanted
[Accessed 3 August 2023].

Oireacthas, 2017. *Joint Committee on Communications, Climate Action and Environment debate - Tuesday, 20 Jun 2017 - Decarbonising Transport: Discussion.* [Online] Available at: https://www.oireachtas.ie/en/debates/debate/joint_committee_on_communications_climate_action_and_environment/2017-06-20/3/?highlight%5B0%5D=irish&highlight%5B1%5D=electric&highlight%5B2%5D=vehicle&highlight%5B3%5D=owners&highlight%5B4%5D=association [Accessed 27 January 2023].

O'Keefe, P., 2020. *Production of Nature Re-Visited.* [Online] Available at: https://antipodeonline.org/wp-content/uploads/2020/07/OKeefe-2020_Production-of-Nature-Re-Visited_Antipode-Online.pdf [Accessed 16 October 2022].

Palm, A., 2020. Early adopters and their motives: Differences between earlier and later adopters of residential solar photovoltaics. *Renewable and Sustainable Energy Reviews,* Volume 133, p. 133.

Pandey, V., Vidal, N., Panwar, R. & Nafees, L., 2019. Characterization of Sustainability Leaders and Laggards in the Global Food Industry. *Sustainability,* 11(18).

PBO, 2022. *An Overview of Ireland's Electric Vehicle Incentives and a Comparison With International Peers,* Dublin: Parliamentary Budget Office.

Peck, J., 2010. Zombie neoliberalism and the ambidextrous state. *Theoretical Criminology,* 14(1), p. 104–110.

Peck, J., Brenner, N. & Theodore, N., 2018. Actually Exisiting Neoliberalism. In: D. Cahill, M. Cooper, M. Konings & D. Primrose, eds. *The Sage Handbook of Neoliberalism.* London: Sage, pp. 3-16.

Peck, J. & Theodore, N., 2019. Still Neoliberalism?. *The South Atlantic Quarterly,* 118(2), pp. 246-265.

Peck, J., Theodore, Nik & Brenner, N., 2013. Neoliberal Urbanism Redux?. *International Journal of Urban and Regional Research,* 37(3), pp. 1091-1099.

Peck, J. & Tickell, A., 2002. Neoliberalizing space. *Antipode,* 34(3), pp. 380-404.

Poorthuis, A., Power, D. & Zook, M., 2020. Attentional Social Media: Mapping the Spaces and Networks of the Fashion Industry. *Annals Of The American Association Of Geographers,* 110(4), pp. 941-966.

Punch, M., 2005. Problem Drug Use and the Political Economy of Urban Restructuring: Heroin, Class and Governance in Dublin. *Antipode,* 37(4), pp. 754-774.

Rancière, J., 2004. *The Politics of Aesthetics The Distribution of the Sensible.* New York; London: Continuum international publishing group.

Rancière, J., 2010. *Dissensus: On politics and aesthetics.* New York: Bloomsbury.

REA, 2022. *Energy Transition Readiness Index,* London: The Association for Renewable Energy and Clean Technology (REA).

Reuschke, D. & Felstead, A., 2020. Changing workplace geographies in the COVID-19 crisis. *Dialogues in Human Geography,* 10(2), pp. 208-212.

Reuters, 2020. *U.S. utilities, Tesla, Uber create lobby group for electric vehicle industry to boost sales.* [Online]
Available at: https://www.cnbc.com/2020/11/18/utilities-tesla-uber-create-us-lobby-group-for-ev-industry.html
[Accessed 15 April 2023].

Riofrancos, T., 2019. What Green Costs. *Logic Nature,* 07 December, Issue 9.

Riofrancos, T., 2020. *Seize and Resist.* [Online]
Available at: https://thebaffler.com/salvos/seize-and-resist-riofrancos
[Accessed 2 November 2020].

Riofrancos, T. et al., 2023. *Achieving Zero Emissions with More Mobility,* California: UC Davis Climate and Community Project.

Robinson, G., 2021. Capturing a moving target: Interviewing fintech experts via LinkedIn. *Area,* 53(4), pp. 671-678.

Rodgers, S. & Moore, S., 2018. Platform urbanism: An introduction. *Mediapolis: A Journal of Cities and Culture,* 23(4).

Rogers, E., 2003. *Diffusion of Innovations.* 5th ed. New York: Free Press.

Rohracher, H. & Späth, P., 2014. The Interplay of Urban Energy Policy and Socio-technical Transitions: The Eco-cities of Graz and Freiburg in Retrospect. *Urban Studies,* 51(7), pp. 1415-1431.

Rosen, J. & León, L. F. A., 2022. The Digital Growth Machine: Urban Change and the Ideology of Technology. *Annals of the American Association of Geographers,* 112(8), pp. 2248-2265.

Rudolph, D., 2022. The question of 'sustainable' technology: From socio-ecological fixes to transformations. *Human Geography,* 16(1), p. 81–86.

Ruppert, E., Law, J. & Savage, M., 2013. Reassembling Social Science Methods: The Challenge of Digital Devices. *Theory, Culture & Society,* 30(4), pp. 22-46.

Russell, L., 2013. *Elsewhere, After the Flood: Glitch Feminism and the Genesis of Glitch Body Politic.* [Online] Available at: https://rhizome.org/editorial/2013/mar/12/glitch-body-politic/ [Accessed 11 April 2023].

Russell, L., 2020. *Glitch Feminism A Manifesto.* London: Verso Books.

Sadowski, J., 2020. Cyberspace and cityscapes: On the emergence of platform urbanism. *Urban Geography,* 41(3), pp. 448-452.

Sadowski, J. & Gregory, K., 2017. *Amazon is running its own hunger games – and all the players will be losers.* [Online]

Available at: https://www.theguardian.com/commentisfree/2017/dec/07/amazon-hunger-games-players-losers-second-headquarters-site-us-techno-capitalist [Accessed 19 April 2023].

Sayers, M. & Byrne, J., 2021. *Houses of the Oireachtas Open Data APIs.* [Online] Available at: https://data.oireachtas.ie/ie/oireachtas/committee/dail/33/joint_committee_on_environment_and_climate_action/submissions/2021/2021-11-30_opening-statement-john-byrne-ecars-manager-esb_en.pdf
[Accessed 3 August 2023].

Scholfield, C., 2020. *Chris Schofield & "Need To Charge" App..* [Online] Available at: https://www.youtube.com/watch?v=Cq_3Rnwza2M&t=493s [Accessed 12 April 2023].

Schor, J. B. & Vallas, S. P., 2021. The Sharing Economy: Rhetoric and Reality. *Annual Review of Sociology,* Volume 47, pp. 369-389.

Schot, J. & Geels, F., 2007. Niches in evolutionary theories of technical change. *Niches in evolutionary theories of technical change. J Evolutionary Economics,* Volume 17, pp. 605-622.

Schot, J., Kanger, L. & Verbong, G., 2016. The role of users in shaping transitions to new energy systems. *Nature Energy,* 1(5).

Schou, J. & Hjelholt, M., 2019. Digital state spaces: state rescaling and advanced digitalization. *Territory, politics, governance,* 7(4), pp. 438-45.

SEAI, 2020. *Energy Security in Ireland,* Dublin: Sustainable Energy Authority of Ireland.

SEAI, 2023. *Electric Vehicles.* [Online] Available at: https://www.seai.ie/technologies/electric-vehicles/ [Accessed 12 April 2023].

Shakil, I., 2023. *Canadian wildfires could persist for rest of 'marathon' summer*. [Online]
Available at: https://www.reuters.com/world/americas/record-setting-canadian-wildfires-could-persist-rest-marathon-summer-2023-08-11/?UTM_CAMPAIGN=Big_Moments&UTM_SOURCE=Google&UTM_MEDIUM=Sponsored
[Accessed 14 August 2023].

Shehadi, S., 2020. *Dublin tops European HQ location rankings.* [Online] Available at: https://www.fdiintelligence.com/content/feature/dublin-tops-european-hq-location-rankings-77217
[Accessed 14 October 2022].

Sheller, M., 2004. Automotive Emotions: Feeling the Car. *Theory, Culture & Society*, 21(4-5), p. 221–242.

Sheller, M., 2018. *Mobility Justice the politics of movement in an age of extremes.* 1st ed. New York: Verso.

Shelton, T., 2017. Spatialities of data: mapping social media 'beyond the geotag'. *Geojournal,* 82(4), pp. 721-734.

Shelton, T., Zook, M. & Wiig, A., 2015. The 'actually existing smart city'. *Cambridge Journal of Regions, Economy and Society,* 8(1), pp. 13-25.

Shepardson, D., 2023. *Biden looks to boost EV sales with plan to cut vehicle emissions.* [Online]
Available at: https://www.reuters.com/business/environment/us-proposes-56-vehicle-emissions-cut-by-2032-requiring-big-ev-jump-2023-04-12/
[Accessed 14 August 2023].

Shin, H. B., 2013. The Right to the City and Critical Reflections on China's Property Rights Activism. *Antipode,* 45(5), pp. 1167-1189.

Shin, H. B., 2018. Urban Movements and the Genealogy of Urban Rights Discourses: The Case of Urban Protesters against Redevelopment and Displacement in Seoul, South Korea. *Annals Of The American Association Of Geographers,* 108(2), pp. 356-369.

SIMI, 2023. *Motorstats the official statistics of the Irish Motor Industry.* [Online] Available at: https://stats.beepbeep.ie/ [Accessed 24 August 2023].

Simmie, J., 2020. Agency, new technological path creation and long waves of local economic growth in Oxfordshire. *Local Economy,* 35(8), pp. 723-746.

Skjølsvold, T. M., Henriksen, I. M. & Ryghaug, M., 2022. Beyond the car: how electric vehicles may enable new forms of material politics at the intersection of the smart grid and smart city. *Urban Geography,* pp. 1-18.

Smith, A. & Raven, R., 2012. What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy,* 41(6), pp. 1025-1036.

Smith, A., Stirling, A. & Berkhout, F., 2005. The Governance of Sustainable Socio-technical Transitions. *Research Policy,* 34(10), p. 1491–1510. .

Smith, N., 1984a. *Uneven Development Nature, Capital, and the Production of Space.* Athens, Georgia: The University of Georgia Press.

Smith, N., 1984b. Deindustrialisation and Regionalisation: Class Alliance and Class Struggle. *Thirtieth North American Meetings of the Regional Science Association,* Volume 54, pp. 113-128.

Smith, N., 2002. New Globalism, New Urbanism: Gentrification as Global Urban Strategy. *Antipode,* 34(3), pp. 427-450.

Smith, N. & O'Keefe, P., 1980. Geography, Marx, and the concept of nature.. *Antipode,* 12(2), pp. 30-39.

Smith, W. J., 2010. Can EV (electric vehicles) address Ireland's CO2 emissions from transport?. *Energy,* 35(12), pp. 4514-4521.

Sovacool, B. K. & Brisbois, M.-C., 2019. Elite power in low-carbon transitions: A critical and interdisciplinary review. *Energy Research & Social Science,* Volume 57.

Sovacool, B. K., Daniels, C. & AbdulRefiu, A., 2022. Transitioning to electrified, automated and shared mobility in an African context: A comparative review of Johannesburg, Kigali, Lagos and Nairobi. *Journal of Transport Geography,* Volume 98.

Sovacool, B. K., Kester, J., Noel, L. & de Rubens, G. Z., 2019a. Energy Injustice and Nordic Electric Mobility: Inequality, Elitism, and Externalities in the Electrification of Vehicle-to-Grid (V2G) Transport. *Ecological Economics,* Volume 157, pp. 205-217.

Sovacool, B. K., Kester, J., Noel, L. & de Rubens, G. Z., 2019b. Income, political affiliation, urbanism and geography in stated preferences for electric vehicles (EVs) and vehicle-to-grid (V2G) technologies in Northern Europe. *Journal of transport geography,* Volume 78, pp. 214-229.

Srivastava, P. & Hopwood, N., 2009. A Practical Iterative Framework for Qualitative Data Analysis. *International Journal of Qualitative Methods,* 8(1), p. 76–84.

Srnicek, N., 2017. *Platform Capitalism.* 1st ed. Cambridge; Malden: Polity Press.

Stokstad, E., 2020. *When COVID-19 silenced cities, birdsong recaptured its former glory.* [Online]
Available at: https://www.science.org/content/article/when-covid-19-silenced-cities-birdsong-recaptured-its-former-glory
[Accessed 2nd August 2023].

Storper, M. & Walker, R., 1989. *The Capitalist Imperative.* 1st ed. Oxford: Blackwell.

Stringer, D. & Park, K., 2021. *Why an Electric Car Battery Is So Expensive, For Now.* [Online]
Available at: https://www.bloomberg.com/news/articles/2021-09-16/why-an-electric-car-battery-is-so-expensive-for-now-quicktake?in_source=embedded-checkout-banner
[Accessed 2nd August 2023].

Sundén, J., 2015. On trans-, glitch, and gender as machinery of failure. *First Monday,* 20(4).

Swyngedouw, E. & Heynen, N. C., 2003. Urban Political Ecology, Justice and the Politics of Scale. *Antipode,* 35(5), pp. 898-918.

Teljeur, C., Darker, C., Barry, J. & O'Dowd, T., 2016. *The Trinity National Deprivation Index for Health and Health Services Research 2016,* Dublin: Trinity College.

The European Parliament and the Council of the European Union, 2019. *Directive (EU) 2019/944 of the European Parliament and of the Council of June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU,* Brussels: Official Journal of the European Union.

Tolia-Kelly, D. P., 2017. Rancière and the re-distribution of the sensible: The artist Rosanna Raymond, dissensus and postcolonial sensibilities within the spaces of the museum. *Progress in Human Geography,* 43(1), pp. 123-140.

Townsend, A., 2013. Smart Cities: Buggy and Brittle. *Places Journal.*

Trudell, C., 2023. *BP to Give Uber Drivers VIP Treatment at EV Charging Stations.* [Online]
Available at: https://www.bloomberg.com/news/articles/2023-03-31/bp-to-give-

uber-drivers-vip-treatment-at-ev-charging-stations#xj4y7vzkg
[Accessed 15 April 2023].

Tyfield, D., 2013. Transportation and Low-carbon Development. In: F. Urban & J. Nordensvard, eds. *Low-carbon Development: Key Issues.* London: Routledge, p. 108–201.

Tyfield, D., 2014. Putting the Power in 'Socio-Technical Regimes' – EMobility Transition in China as Political Process. *Mobilities,* 9(4), pp. 585-603.

Uber for Business, 2022. *Uber for Business helps corporate users report on sustainability.* [Online]
Available at: https://www.uber.com/en-CA/blog/uber-sustainability-insights/
[Accessed 4 April 2023].

Uhlenbroich, B., 2022. *Porsche continues to build combustion engines!.* [Online]
Available at: https://www.bild.de/geld/wirtschaft/wirtschaft/drohendes-verbot-hin-oder-her-porsche-baut-weiter-verbrenner-80586654.bild.html
[Accessed 3 August 2023].

UK Department for Transport, 2023. *Consultation on a zero emission vehicle (ZEV) mandate and CO2 emissions regulation for new cars and vans in the UK,* London: UK Department for Transport.

UNEP, 2022. *The Closing Window Climate crisis calls for rapid transformation,* Nairobi: United Nations Environmental Programme.

UNFCC, 2023. *The Paris Agreement | UNFCCC.* [Online]
Available at: https://unfccc.int/process-and-meetings/the-paris-agreement
[Accessed 14 August 2023].

UNHabitat, 2022. *Envisaging the Future of Cities,* Nairobi, Kenya: UN Habitat.

Un-Noor, F, Padmanaban, S., Mihet-Popa, L., Mollah, M. N. & Hossain, E., 2017. A Comprehensive Study of Key Electric Vehicle (EV) Components, Technologies, Challenges, Impacts, and Future Direction of Development. *Energies,* 10(8).

UNOCHA, 2022. *Horn of Africa Drought Regional Humanitarian Overview & Call To Action,* Geneva: UNOCHA.

Upham, P., Kivimaa, P., Mickwitz, P. & Åstrand, K., 2014. Climate policy innovation: a sociotechnical transitions perspective. *Environmental Politics*, 23(5), pp. 774-794.

Urry, J., 2004. The 'System' of Automobility. *Theory, Culture & Soceity,* 21(4-5), p. 25–39.

Urry, J., 2007. *Mobilities.* 1st ed. Cambridge: Polity Press.

van Doorn, N., Mos, E. & Bosma, J., 2021. Actually Existing Platformization: Embedding Platforms in Urban Spaces through Partnerships. *The South Atlantic Quarterly,* 120(4), pp. 715-731.

Vecchio, G., Tiznado-Aitken, I., Albornoz, C. & Tironi, M., 2022. Delivery workers and the interplay of digital and mobility (in)justice. *Digital Geogrpahy and Society,* Volume 3, p. 100036.

Volkswagen Group, 2021a. *Brands and Business Fields.* [Online] Available at: https://annualreport2021.volkswagenag.com/divisions/brands-and-business-fields.html
[Accessed 3 August 2023].

Volkswagen Group, 2021b. *New Auto: Volkswagen Group set to unleash value in battery-electric autonomous mobility world.* [Online] Available at: https://www.volkswagen-newsroom.com/en/press-releases/new-auto-volkswagen-group-set-to-unleash-value-in-battery-electric-autonomous-mobility-world-7313
[Accessed 3 August 2023].

Volkswagen, 2023. *The ID.4 | Models | Volkswagen Ireland.* [Online] Available at: https://www.volkswagen.ie/en/new-cars/ID4.html [Accessed 29 June 2023].

Watts, M., 2000. Political Ecology. In: E. Sheppard & T. J. Barnes, eds. *A Companion to Economic Geography.* Malden, MA: Blackwell Publishing Ltd, pp. 257-275.

Wells, P. & Nieuwenhuis, P., 2012. Transition failure: Understanding continuity in the automotive industry. *Technological Forecasting & Social Change,* Volume 79, pp. 1681-1692.

While, A., Jonas, A. E. & Gibbs, D., 2004. The Environment and the Entrepreneurial City: Searching for the Urban `Sustainability Fix' in Manchester and Leeds. *International Journal of Urban and Regional Research,* 28(3), pp. 549-69.

While, A., Jonas, A. E. & Gibbs, D., 2010. From sustainable development to carbon control: eco-state restructuring and the politics of urban and regional development. *The Transactions of the Institute of British Geographers,* 35(1), pp. 76-93.

WMO, 2023. *Copernicus confirms July 2023 was the hottest month ever recorded.* [Online]
Available at: https://public.wmo.int/en/media/news/copernicus-confirms-july-2023-was-hottest-month-ever-recorded#:~:text=%E2%80%9C2023%20is%20currently%20the%20third,%C2%B0C%20above%20preindustrial%20levels.
[Accessed 14 August 2023].

World Bank, 2023. *Urban Development Overview - World Bank.* [Online] Available at: https://www.worldbank.org/en/topic/urbandevelopment/overview#:~:text=Today%2C%20some%2056%25%20of%20the,people%20will%20live%20in%20cities

.
[Accessed 14 August 2023].

Yergin, D., 1990. *The Prize: The Epic Quest for Oil, Money, and Power.* 3rd ed. New York: Free Press.

Appendices

Appendix A: Authorship declaration form for Chapter 6

Maynooth University
National University of Ireland Maynooth

Maynooth University
Department of Geography

This form is to accompany the submission of a PhD that contains research reported in published or unpublished work. **Please include one copy of this form for each co-authored work.** This form along with the published work should, under normal circumstances, appear in an Appendix.

Authorship Declaration Form

Publication Details:

Thesis Chapter/Pages	Chapter 7
Publication title	Cross-class alliances and the rise of electric vehicles in Dublin
Publication status	Accepted
Type of publication	Journal Article
Publication citation	Ó Maonaigh, C. (2023). Cross-class alliances and the rise of electric vehicles in Dublin. Human Geography, 0(0).

Nature/extent of my contribution to the work detailed above is as follows:

Nature/Extent of Contribution	**Lead author**
Full authorship	☒ Yes ☐ No

The following co-authors contributed to the work (all contributing co-authors):

Name	Nature of contribution
N/A	N/A

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student's and co-author's contribution to this work

	Name	Signature	Date
Student	Conchúr Ó Maonaigh		16/08/2023

Appendix B: Interview guide for EV users

1. How and why did you become an EV driver?
2. What are the main obstacles in 1) acquiring the car 2) using the car daily?
3. How is an EV different to the experience of driving a petrol or diesel engine?
4. What are the frustrations of driving an EV?
5. How is your range different driving an EV?
6. What can you tell me about your experience with range anxiety?
7. What can you tell me about charging etiquette?
8. What are the charging infrastructures like (home versus public charging)?
9. What about costs of driving an EV? Do EVs save money?
10. Do you track your data in the car? For example, your kWh/per 100 km?
11. What software imbedded in the car do you like to use?
12. What software outside on your phone do you like to use?
13. Is privacy an issue for you?
14. Do you try reducing the data you produce or stop firms from getting it?
15. There's a lot of interest in degrowth agendas in transport, for example, reducing travel and using public and shared forms of transport. Do you think it would suit your lifestyle?
16. What influence do you think low carbon automobility might have the economy?
17. Could you explain how environmental factors influenced your decision to acquire an EV?
18. Do you think your gender played a role in your adoption?
19. Do you think your class played a role in adoption?
20. Do you try and get other to drive EVs?
21. Do you try and shape policy? In what ways? What policies?
22. Why things like owners' clubs exist? Do they shape the industry? Are they political?
23. Who do you think the leaders, laggards and inhibitors are?
24. What does the future of Electric Vehicles look like?

Appendix C: Interview guide for private actors

1. What role do you play in your company and what activities and projects have you undergone relating to decarbonising transportation?
2. What are the most innovative decarbonising projects that you have worked on?
3. Who is influential in driving projects or activities forward in your company?
4. Who do you collaborate with A. within and B. outside of your organization to drive your work?
5. Do you have any strategic relationships relating to decarbonisation with the A. public sector and with B. other firms and what are they like?
6. Do you have main competitors, and what sort of experiences have you had with them?
7. How does your work engage with different scales of activity i.e., national, regional, local scales?
8. Are there place-specific challenges and opportunities that emerge in Ireland or Dublin in your work, compared to what might arise in other countries and cities in Europe?
9. Are there challenges with A. insurance and B. labour around the decarbonising projects you work on?
10. What is the A. infrastructural, or B. technical developments needed for your decarbonising activities to grow?
11. What public policies or developments are needed that will help your decarbonising activities grow?
12. What are the sorts of obstacles that you have encountered during this work and how did you intervene when obstacles emerged?
13. Have you ever had any disputes on projects, and how were they settled?
14. Have you encountered any resistance or opposition during your work?
15. What are the main lessons you learned from working on projects?
16. How does your work engage or communicate with electric vehicle motorists?
17. What do you think stops drivers from switching to EVs, and have your activities engaged in that?

18. Have you been involved in any projects that deal with the issue of “range anxiety”?
19. What established processes and revenues are A. changing and B. what new ones are emerging from your decarbonising activities?
20. How do you raise capital to invest in decarbonising projects?
21. How do you generate money or revenue from decarbonising projects?
22. How do the decarbonising activities in your company relate to consumer costs?
23. Do you anticipate any advantages arising from a cost reduction in vehicle electrification or renewable energy?
24. In your experience, what organizations or actors are A. leading B. lagging and C. Inhibiting low carbon transitions in Dublin or Ireland?
25. What do you think are A. the main challenges and B. main opportunities for low carbon transitions that you may have encountered in your work?

Appendix D: Interview guide for public actors

1. What role do you play in your organisation and what activities and projects have you undergone relating to decarbonising transportation?
2. What role did you play in the rollout of EV charge point infrastructure?
3. Could you tell me about the sort of everyday working relationships you have with other public sector bodies to mobilise the EV rollout?
4. Did you have any interaction with key civil servants in Merrion St relating to EV transitions?
5. Could you tell me about the sort of everyday working relationships you have with the private sector?
6. What sort of relationships do you have with energy providers?
7. Did the project go down any cul-de-sacs?
8. Do private firms chase you to install infrastructure or any other aspect that makes it possible to decarbonise or do you chase after firms?
9. What sort of everyday relationship do you have with A) ESB, B) Eirgrid & C) the SEAI?
10. Are there other companies, states, or cities you look to for best practice and why?
11. Do you have any other essential relationships relating to your activities?
12. Are there place-specific challenges that emerge in Dublin in your work, compared to what might arise in other countries and cities in Europe?
13. What are sorts of everyday challenges that emerge in your work around decarbonisation?
14. What are the regulatory or policy interventions that you anticipate emerging to meet the CAP’s targets?
15. Is the state agile in their approach to decarbonisation?
16. What are the main obstacles to EV uptake that you’ve encountered in your work?
17. Are there any insurmountable obstacles that you’ve come across in your work relating to EV transitions?

18. Have you ever had any disputes on energy related projects, and how were they settled?
19. Have you encountered any resistance or opposition during your work on energy related projects?
20. How are the costs for transport/energy related projects managed?
21. Are there any diverse investment methods on energy you may encountered in your work i.e., public-private partnerships and how does their ownership structure work?
22. Has there been a disparity in indigenous vs foreign investment that you may have encountered in your work?
23. What is dominant political-economic thinking around energy in your organisation on decarbonising? i.e., free market, interventionist, mixed approaches?
24. How do we get the right amount of energy, at the right amount of time, in the right place to be able to offer the relevant public charging network?
25. How do you engage with the public to understand their energy wants, needs, and desires?
26. In your experience, what organizations or actors are A. leading B. lagging and C. Inhibiting low carbon transport in Dublin?
27. What do you think are A. the main challenges and B. main opportunities for low carbon transitions that you may have encountered in your work?

Appendix E: Biographical information on EV users

Respondent	Age	Gender	Experience driving an EV	Current car model
1	32-41	M	10 years	Tesla Model X
2	32-41	M	10 years	Renault Zoe
3	52-61	M	10 years	Nissan LEAF
4	42-51	F	5 years	Nissan LEAF
5	22-31	M	5 years	Nissan LEAF
6	62-71	M	10 years	Nissan LEAF
7	52-61	M	2 years	Nissan LEAF
8	62-71	M	5 years	Tesla Model X
9	32-41	F	2 years	Tesla Model 3
10	32-41	F	1 year	Renault Zoe
11	42-51	F	1 year	Kia e-Niro
12	62-71	F	10 years	Hyundai Kona
13	32-41	F	2 years	Nissan Leaf
14	32-41	F	2 years	Kia e-Niro
15	32-41	M	1 year	Renault Zoe

16	52-61	M	1 year	Nissan LEAF
17	62-71	F	1 year	Tesla Model X
18	32-41	F	1 year	Hyundai Ioniq
19	62-71	F	1 year	Nissan Leaf
20	62-71	F	1 year	Volkswagen ID.3
21	62-71	F	5 years	Kia Soul
22	62-71	F	5 years	Renault Zoe
23	52-61	M	10 years	Renault Zoe
24	42-51	F	3 years	Mercedes B 250e
25	52-61	F	10 years	Nissan LEAF
26	32-41	M	5 years	Renault Zoe
27	32-41	M	10 years	*hires a car
28	42-51	M	5 years	Jaguar I-Pace
29	32-41	F	5 years	Nissan LEAF
30	32-41	M	6 years	Kia e-Niro
31	42-51	F	1 year	Hyundai Kona
32	52-61	M	2 years	Renault Zoe
33	52-61	M	4 years	Volkswagen e-Golf

34	42-51	M	5 years	Volkswagen ID.3
35	42-51	M	1 year	Nissan LEAF
36	62-71	F	6 years	Nissan LEAF
37	62-71	M	3 years	Nissan LEAF
38	42-51	M	3 years	Volkswagen ID.3
39	52-61	M	3 years	Renault Zoe

Appendix F: Biographical information on private sector respondents.

Respondent	Sector	Role	Type	Activities
40	Finance	PL	Irish MNC	Procuring a corporate EV fleet
41	Automotive Innovation	CEO	Irish Start up	Developing battery technologies to extend battery range
42	Automotive OEM	PL	Japanese TNC	Managing and directing the OEMs' EV strategy in Ireland.
43	Automotive Dealer	CEO	Irish Start up	Managing and directing the company
44	Automotive Journalist	Free-lance	Irish Media	Managing website, writing articles, and lobbying industry
45	Automotive Innovation	PL	Dutch Start up	Retrofitting ICE to EV
46	Energy Production and Supply	PL	British TNC	Constructing ultra highspeed charging hubs.
47	Automotive Innovation	PL	Irish Start up	Retrofitting ICE to EV
48	Transport & Logistics	PL	French TNC	Procuring EV fleets
49	Charge Point Technology	MD	British SME	Installing EV charging infrastructure
50	Automotive OEM	PL	German TNC	Managing and directing OEMs EV sales strategy in Ireland.

51	Charge installation and maintenance	CEO	Irish SME	Direct and manage company.
52	Energy Supply	PL	Irish SME	Developing EV infrastructure
53	Automotive Leasing	PL	Dutch TNC	Procuring and managing an EV fleet
54	Charge point installation and maintenance	CEO	Irish SME	Directing and managing company.
55	Mobility-as-a-service	HOO	German TNC	Procuring and managing an EV fleet
56	Energy production and supply	PL	Irish TNC	Developing EV infrastructure
57	Charge point operation	CEO	Irish SME	Developing a public charging infrastructure
58	Energy production and supply	PL	Irish TNC	Developing EV charging infrastructure
59	Automotive sector representative	MD	Irish lobbyist	Direct and manage company
60	Energy sector representative	MD	Irish lobbyist	Procuring Electric Vans and CNG Fleet
61	Energy infrastructure	HOO	German TNC	Developing EV charging infrastructure
62	Automotive dealer	MD	Irish SME	Managing and directing a company
PL: Project Leader; CEO: Chief Executive Officer; MD: Managing Director; HOO: Head of Operations				

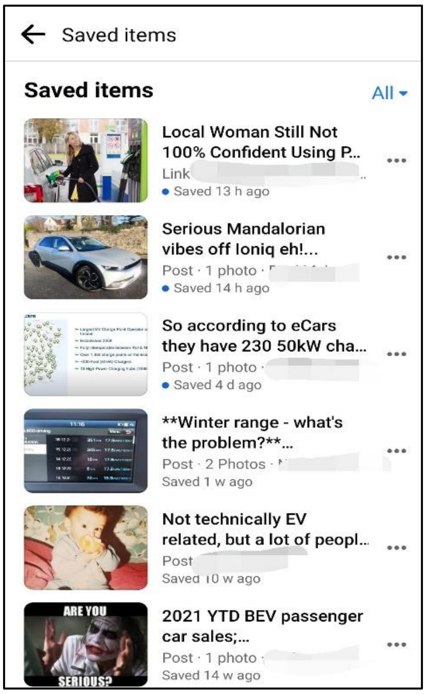
MNC: Multinational Corporation; TNC: Transnational Corporation; SME: Small Medium Enterprise

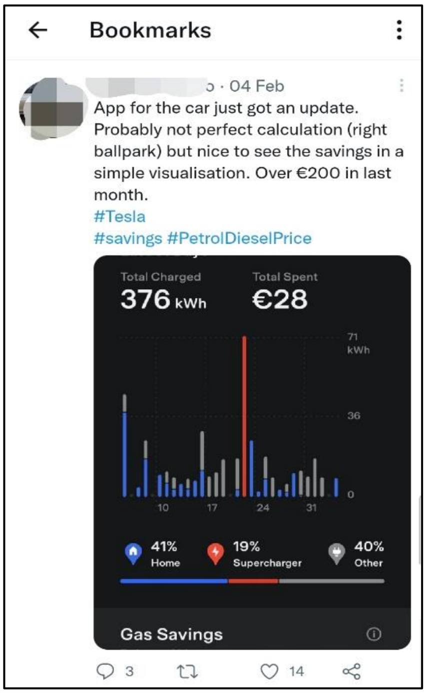
Appendix G: Biographical information on public sector respondents

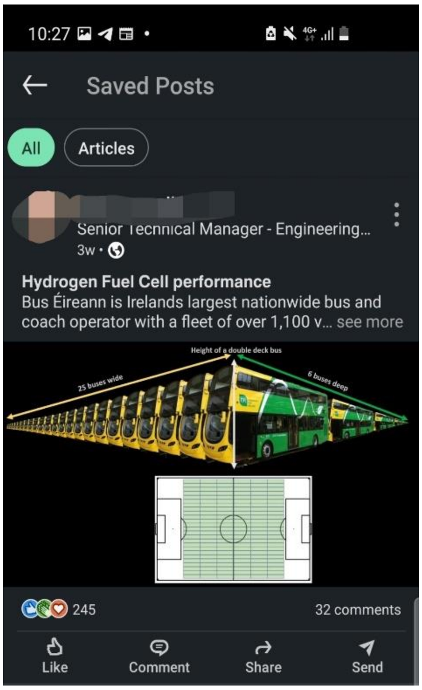
Respondent number	Sector	Role	Type	Activities
63	Energy	PL	Regulator	Market compliance
64	Transport	PL	Central Government	Developing policies to promote the use of EVs
65	Energy	PL	Local authorities	Developing EV infrastructure strategy
66	Transport	PL	Local authorities	Developing EV infrastructure strategy
67	Transport	PL	Local authorities	Helped to bridge strategies between the central state and local authorities
68	Politics	EO	Local authorities	Elected official seeking to develop EV charging infrastructure
69	Energy	PL	Regulator	Developing policies to promote the adoption and use of EVs
70	Energy	PL	Regulator	Conducted research on the EV sector

71	Energy	MD	Irish semi-state	Developing EV infrastructure
72	Energy	MD	Irish semi-state	Developing EV infrastructure
PL: Project Leader; MD: Managing Director; EO: Elected Official				

Appendix H: Social Media Repositories







Appendix I: EV users' Scoring Matrix (Automotive Sector)

Respondent Number	Tesla	Nissan	Renault	Volkswagen	Toyota	Hyundai	Kia
1	6	11	3	4	2	0	0
2	11	17	6	2	1	1	0
3	18	3	2	5	6	0	0
4	13	19	3	1	7	4	0
5	0	1	2	0	1	1	0
6	1	2	1	0	0	0	0
7	0	4	0	0	3	0	2
8	8	1	1	0	7	0	1
9	30	0	0	2	0	0	0
10	14	1	11	0	0	0	0
11	2	0	0	1	1	0	8
12	1	5	0	1	0	1	0
13	6	5	1	3	3	0	1
14	2	4	1	2	0	4	16
15	29	1	14	4	10	2	0
16	0	4	0	0	2	0	0
17	12	1	0	0	0	0	0
18	0	1	1	0	0	13	0
19	1	7	0	0	2	0	0
20	0	1	0	6	0	0	0
21	4	15	0	1	5	3	18
22	1	1	3	0	0	0	0
23	10	0	6	3	0	1	0
24	1	1	0	1	1	3	4
25	0	14	4	0	0	0	0
26	1	6	10	2	2	4	0
27	6	3	1	4	2	0	0
28	7	1	1	0	0	8	0
29	5	15	0	0	3	2	0
30	1	13	2	1	7	0	5
31	5	0	0	7	0	16	1
32	5	1	11	0	1	0	0
33	10	10	1	17	0	0	0
34	3	4	0	8	2	1	0
35	6	16	2	1	3	2	1
36	4	4	8	0	2	0	0
37	5	22	6	13	3	0	0
38	5	0	1	10	3	0	0
39	3	2	26	8	0	1	1
Totals	**236**	**216**	**128**	**107**	**79**	**67**	**58**
Mode	36	35	26	24	25	17	11

Respondent Number	BMW	Audi	Porsche	Mercedes	Skoda	Jaguar	Reva
1	1	1	0	0	0	0	0
2	1	0	0	1	0	0	0
3	1	0	3	1	0	0	0
4	1	0	0	0	3	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	4	0	0
8	2	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	1	0	0
14	0	0	0	0	1	0	0
15	5	1	0	0	0	0	0
16	1	0	2	1	6	0	0
17	0	3	0	0	0	2	0
18	0	2	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	1	0	0	0	0
23	1	2	5	2	0	0	0
24	2	2	0	6	0	0	0
25	0	0	0	0	0	0	13
26	1	1	0	0	2	0	0
27	3	0	1	1	0	0	0
28	7	0	2	1	0	13	0
29	0	0	3	0	0	0	0
30	2	0	0	0	0	0	0
31	1	0	0	1	0	0	0
32	0	2	0	2	1	0	0
33	0	4	0	0	1	0	0
34	2	2	1	2	0	0	0
35	0	3	0	0	0	0	0
36	0	0	0	0	0	0	0
37	2	3	0	1	1	0	0
38	0	0	0	0	0	0	0
39	1	2	3	1	0	1	0
Totals	**34**	**28**	**21**	**20**	**20**	**16**	**13**
Mode	17	14	9	12	9	3	1

Respondent Number	Ford	Honda	General Motors	Lexus	Volvo	Mitsubishi	Mini
1	0	0	0	0	0	0	0
2	1	0	1	0	0	1	0
3	1	5	1	0	0	0	0
4	0	0	0	1	2	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	1	0	3	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	1	0	1	0	1	0
14	0	0	0	0	0	0	0
15	1	1	4	0	0	0	0
16	0	0	0	0	0	0	0
17	1	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	2
22	0	0	0	0	0	0	0
23	0	0	1	0	1	0	0
24	0	0	0	0	2	0	0
25	0	0	0	0	0	2	0
26	0	0	0	1	0	0	0
27	0	0	1	0	0	0	0
28	0	0	0	0	0	0	0
29	2	0	0	0	0	0	0
30	1	0	0	0	0	0	0
31	0	0	0	0	0	0	0
32	1	1	0	0	0	0	0
33	0	0	0	0	0	0	0
34	1	0	0	1	0	1	0
35	0	0	0	0	0	0	1
36	0	0	0	0	0	0	0
37	0	0	0	0	2	0	1
38	0	0	0	0	0	0	0
39	1	0	0	0	0	0	0
Totals	**10**	**9**	**8**	**7**	**7**	**5**	**4**
Mode	8	5	5	5	4	4	3

Respondent Number	Chrysler	Mazda	MG	JLR	Nikola	Fiat	Citroen
1	0	0	0	0	0	0	0
2	3	0	0	0	0	0	0
3	0	0	0	0	4	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	3
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	1	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
26	0	0	0	0	0	2	0
27	0	0	0	4	0	0	0
28	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
31	0	2	0	0	0	0	0
32	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0
35	0	0	2	0	0	0	0
36	0	0	0	0	0	0	0
37	1	0	2	0	0	1	0
38	0	0	0	0	0	0	0
39	0	1	0	0	0	0	0
Totals	**4**	**4**	**4**	**4**	**4**	**3**	**3**
Mode	2	3	2	1	1	2	1

Respondent Number	Suzuki	Geely	Nio	Opel	Peugeot	Range Rover	Bentley
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	1	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	1	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	1	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0
27	0	1	0	0	0	0	0
28	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0
35	3	0	0	1	1	0	0
36	0	0	0	0	0	0	0
37	0	1	0	0	0	0	1
38	0	0	0	0	0	0	0
39	0	0	0	1	1	1	0
Totals	**3**	**2**	**2**	**2**	**2**	**2**	**1**

Mode	1	2	2	2	2	2	1

Appendix J: EV users' Scoring Matrix (Owners groups)

Respondent Number	IEVOA	Irish EV Owners Facebook	Tesla EV Owners IRL	Clare EV Owners	ID3 Owners group	Tesla EV Owners UK	Renault Owners Club UK
1	2	0	0	0	0	0	0
2	1	0	0	0	0	0	0
3	1	0	0	0	0	0	0
4	3	2	0	0	0	0	0
5	2	0	0	0	0	0	0
6	2	0	0	0	0	0	1
7	0	0	0	0	0	0	0
8	3	0	3	3	0	0	0
9	1	0	3	0	0	1	0
10	1	0	1	0	0	0	0
11	1	0	0	0	0	0	0
12	3	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	3	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	1	3	0	0	0	0	0
19	0	5	0	0	0	0	0
20	1	0	0	0	2	0	0
21	2	2	0	0	0	0	0
22	0	0	0	0	0	0	0
23	2	0	0	0	0	0	0
24	0	0	0	0	0	0	0
25	5	3	0	3	0	0	0
26	2	0	0	0	0	0	0
27	2	1	0	0	0	0	0
28	0	0	0	0	0	0	0
29	1	1	0	0	0	0	0
30	2	0	0	0	0	0	0
31	0	3	0	0	0	0	0
32	0	1	0	0	0	0	0
33	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0
35	0	5	0	0	0	0	0
36	4	0	0	0	0	0	0
37	1	0	0	0	0	0	0
38	0	0	0	0	0	0	0

39	0	2	0	0	0	0	0
Totals	**46**	**28**	**7**	**6**	**2**	**1**	**1**
Mode	23	11	3	2	1	1	1

Respondent Number	ID3 Owners group UK	Dublin EV Owners Clubs	EV Owners Buy and Sell
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	0	0	0
12	0	0	0
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0
17	0	0	0
18	0	0	0
19	0	0	0
20	1	0	0
21	0	0	0
22	0	0	0
23	0	0	0
24	0	0	0
25	0	0	0
26	0	0	0
27	0	1	0
28	0	0	0
29	0	0	0
30	0	0	0
31	0	0	0
32	0	0	0
33	0	0	0
34	0	0	0
35	0	0	1
36	0	0	0
37	0	0	0
38	0	0	0

39	0	0	0
Totals	**1**	**1**	**1**
Mode	1	1	1

Appendix K: EV users' Scoring Matrix (CPOS)

Respondent Number	ESB	EasyGo	Ionity	EO	Gridserve	WeCharge
1	1	0	0	0	0	0
2	8	3	0	0	0	0
3	7	1	0	1	0	0
4	0	0	0	0	0	0
5	11	2	0	0	0	0
6	3	0	0	0	0	0
7	8	0	0	0	2	0
8	0	0	0	0	0	0
9	9	4	0	0	0	0
10	1	0	1	0	0	0
11	0	1	0	0	0	0
12	2	0	0	0	0	0
13	2	0	0	0	0	0
14	3	0	0	0	0	0
15	3	1	0	0	0	0
16	3	0	0	0	0	0
17	0	0	0	0	0	0
18	2	0	0	0	0	0
19	14	0	0	1	0	0
20	2	0	0	0	0	0
21	1	0	0	0	0	0
22	14	4	1	0	0	0
23	2	0	0	0	0	0
24	4	0	0	0	0	0
25	6	0	0	0	0	0
26	11	0	0	0	0	0
27	5	1	0	0	0	0
28	3	3	1	0	0	0
29	17	7	11	0	0	0
30	1	0	0	0	0	0
31	4	1	3	0	0	0
32	0	0	0	0	0	0
33	2	6	5	0	0	0
34	13	1	2	0	0	0
35	11	2	6	0	0	1
36	2	0	0	0	0	0
37	6	0	1	0	0	0
38	1	0	0	0	0	0
39	3	0	0	0	0	0
Totals	8	1	0	0	0	0

Mode	**192**	**38**	**31**	**2**	**2**	**1**
	35	15	9	2	1	1

Appendix L: EV users' Scoring Matrix (State Authorities)

Respondent Number	SEAI	NTA	ASA	Bord Na Mona	Broadcasting authority of Ireland	Department of Transport	Transport For Ireland
1	2	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	1	0	0	0	1	0
8	1	0	2	0	0	0	0
9	0	0	0	0	0	0	0
10	1	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	1	0	0	0	0	0	0
14	2	0	0	0	0	0	0
15	0	0	0	1	0	0	0
16	4	11	0	0	0	0	0
17	0	0	0	1	0	0	0
18	3	0	0	0	0	0	0
19	1	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	3	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	5	0	0	0	0	0	0
25	0	0	0	0	0	0	0
26	0	1	0	0	0	0	0
27	1	0	0	0	1	0	1
28	5	0	0	0	0	0	0
29	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0
31	1	0	0	0	0	0	0
32	3	0	0	0	0	0	0
33	0	0	0	0	0	0	0
34	2	0	0	0	0	0	0
35	0	0	0	0	0	0	0
36	0	0	2	0	0	0	0
37	3	1	0	0	0	0	0
38	1	0	0	0	0	0	0
39	0	0	0	0	0	0	0

Totals	**39**	**14**	**4**	**2**	**1**	**1**	**1**
Mode	36	35	26	24	25	17	11

Appendix M: My suite of digital technologies

Digital Devices	- Internet access - Laptop - Smartphones - External recording devices - Extern memory storage - Printers - Transcription pedals
Platforms	- Social media content, e.g., LinkedIn, Twitter, Facebook - Teleconferencing software e.g., Google Meet, Microsoft Teams, Zoom - Virtual event platforms e.g., Brella - Phone calls e.g., WhatsApp, Telephone, Facebook Messenger - Emails e.g., Gmail, Outlook - Digital documents e.g., consent forms, information sheets, documents obtained from participants - Digital journals e.g., Google Note, Samsung Notes - Scheduling and planning software e.g., Microsoft To Do, Google Calendar
Data tools	- Automatic transcription tools e.g., SpeechExec - Transcription software e.g., Otter.ai - External recording device e.g., Philips's voice recorder DPM8000 - Security tools e.g., Microsoft Authenticator - Scanners e.g., Adobe scan
Analysis	- Coding and analysis software e.g., MAXQDA, NVivo

	- Data analysis programmes e.g., Microsoft Excel