The politics of transition to electric mobility in India

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School of Geography and the Environment

University of Oxford

Gaurav Dubey

Somerville College

Under the supervision of Professor Tim Schwanen

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Abstract

This study investigates how electric mobility in India is shaping and being shaped by the politics of urban mobility systems. Politics here is understood as the process by which trade-offs are resolved between various competing interests associated with urban mobility. The study situates itself within the academic literatures on sociotechnical transitions and transitions politics and employs concepts like sociotechnical imaginaries and policy entrepreneurship to conduct the investigation. The analysis is informed by a range of methods like process tracing and critical discourse analysis and relies on data from interviews and various secondary sources.

The study asks three research questions. Firstly, how, and why were some of the early national policies on road transport electrification in India created? Secondly, what sociotechnical imaginaries around electric mobility are being constructed within the national news media discourse? Thirdly, what changes is electrification triggering in the politics of urban bus systems in India, and how?

The study has the following main findings. Firstly, early national policies on electric mobility were created by set of policy entrepreneurs who discursively constructed landscape pressures for transition to electric mobility. To do this, they connected policy and political demands for growth in manufacturing with the tensions within the internal combustion engine vehicle (ICEV) regime concerning the ICEV system's inability to help India become a global leader in manufacturing. Secondly, two contrasting imaginaries, one of 'environmentally friendly automobility' and another of 'electrification of rickshaws for employment' have been constructed and are circulating within the news media discourse. Thirdly, electrification is changing the politics of bus systems in ways that signal shifts towards improved bus systems with higher efficiency and service levels.

The overall contribution of this thesis is to demonstrate how the transition to electric road-based mobility in India is interwoven with the politics of urban mobility systems in various ways. This entanglement helps understand some key aspects of India's EV transition trajectory so far and points towards implications for the future of urban (electric) mobility in India. The study contributes towards transitions scholarship by demonstrating novel ways in which transitions dynamics and the politics of transitions can unfold in geographies like India.

Acknowledgements

As I started to write the acknowledgements section, I realized I cannot treat the DPhil in isolation from the long journey that brought me to this point in the first case. For someone with my background to get to the stage of submitting their DPhil thesis at Oxford, a whole lot of things have to go right in their life. I believe I have been extremely privileged and fortunate to be one such case. As such, I owe a lot of gratitude to a long list of people (and events) through my life who helped me get here. While it is not possible to enlist all of them, here below is a very modest attempt.

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I'd like to convey my sincerest gratitude to the Oxford India Centre for Sustainable Development and Somerville College for critically providing me the funding to pursue my DPhil as well as other forms of financial support at various stages during the last 5 years. In particular, I'd like to thank Siddharth, Sara, Radhika, and Jan for all of their support and encouragement throughout my DPhil journey.

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Frequently used abbreviations

2W	2-wheeler
3W	3-wheeler
BJP	Bharatiya Janata Party
CDA	Critical Discourse Analysis
DHI	Department of Heavy Industry
Electric 2-wheeler	e2W
Electric 3-wheeler	e3W
EV	Electric vehicle
FAME	Faster Adoption and Manufacturing of Electric (and Hybrid) Vehicles
ICE	Internal Combustion Engine
ICEV	Internal Combustion Engine Vehicle
IE	The Indian Express
IEA	International Energy Agency
INC	Indian National Congress
MLP	Multi-level-perspective
MSF	Multiple-Streams-Framework
NBEM	National Board on Electric Mobility
NCEM	National Council on Electric Mobility
NEBP	National Electric Bus Program
NEMMP	National Electric Mobility Mission Plan
NITI	National Institution for Transforming India
NMCC	National Manufacturing and Competitiveness Council
NMEM	National Mission for Electric Mobility
O&M	Operations and Maintenance
PIB	Press Information Bureau
PLI	Performance Linked Incentive
RTI	Right-to-Information
SIAM	Society of Indian Automobile Manufacturers
SMEV	Society of Manufacturers of Electric Vehicles
ST	Sociotechnical
STI	Sociotechnical imaginaries
STT	Sociotechnical transition
STU	State Transport Undertaking

TOI	The Times of India
TPC	Technopolitical constellations

CHAPTER ONE: INTRODUCTION

This study aims to examine different ways in which the transition to electric road-based mobility (e-mobility) in India is shaping, and being shaped by, the politics of urban passenger mobility systems in India. To substantiate this aim, put it into context and explain its relevance, this chapter proceeds in the following manner. A brief discussion on the ongoing transition to e-mobility is provided below that helps contextualize the study. Thereafter, I explain what I mean by the politics of passenger mobility systems in India and outline some of the ways in which that is shaping, and being shaped by, the ongoing transition to e-mobility. I delineate the aspects of this dynamic on which I focus in this study and discuss why it is relevant to do so. Thereafter, I provide a brief overview of the theoretical frameworks and literatures within which this study is situated and to which it seeks to contribute. The subsequent section outlines the methods and data employed for my research. In the following section, I outline the main contributions of this thesis. The chapter concludes by laying out the structure of the thesis.

For the purposes of this thesis, the following clarifications are useful. 'Transportation', 'passenger transportation' and 'passenger mobility' are used interchangeably in this thesis, and all the terms wherever used, refer to 'urban' passenger transportation or mobility. Further, passenger mobility refers to land-based transportation and thus covers typically the following modes of travel: walking, cycling, 2-wheelers (2Ws), cars (privately owned as well as taxis), bus and rail-based public transport systems, and a wide range of semi-or-non-regulated modes such as cycle rickshaws, auto-rickshaws, and electric rickshaws. While there are water-based modes present in some cities, these are not commonplace, and their electrification is not covered under national policies on electric mobility.

The focus on urban mobility is for multiple reasons. While cities occupy merely 3% of the country's land, they contribute almost 60% to India's GDP Niti Aayog (2022). With only about a third of India's population residing in cities as of 2021, this figure is expected to go beyond 50%

by 2050 (United Nations, 2018). Ever more population living in denser areas and participating in economic activities has direct bearing on travel demand and carbon emissions. Urban India, thus, remains a focus of policymaking, including to a significant degree within the domain of electric mobility (e.g., Government of India, 2022: p. 10). Moreover, electrification of transportation has largely been an urban phenomenon so far (Reddy, 2022). This can be attributed to a wide range of potential factors including range issues of EVs which may be of greater issue in rural areas where travel distances are greater, incomes generally lower and electricity availability typically poorer than in cities. Finally, the full range of multimodal transport systems, which remains a significant theme of interest to this study, is manifested much more prominently in cities than in rural areas, where the incidence of car ownership per capita, for instance, is usually lower than cities (Choudhary and Vasudevan, 2017).

1.1 Transition to electric mobility in India

Between 2005 and 2019, India experienced a nearly fivefold increase in its CO_2 emissions growth rate compared to the global average (IEA, 2022). Among the major emitting sectors, transportation exhibited the highest growth rate, reaching 168% during this timeframe and contributing to 13% of India's energy-related CO_2 emissions in 2019 (ibid.). This surge in emissions is primarily linked to a remarkable rise in motorization, reflected in a 230% increase in the total number of motorized vehicles from 2005 to 2019 (see Government of India, 2021). Given the imperative for decarbonization, along with concerns surrounding urban air pollution, electric mobility has emerged as the key policy instrument (see Government of India, 2015). It is useful to add here that electrification goes beyond issues of carbon emissions and air pollution. Linkages between electrification and political economy are also important. They are one of the key facets of the politics of electrification and this theme will be explored in depth in Chapter Four.

Electrification of transportation in India has been largely driven by national policies. The transition can be traced back to the creation of a National Mission for Electric Mobility (NMEM) in 2011, the first stated policy intent in respect of electric vehicles (EVs) (Press Information Bureau, 2011). Subsequently, the National Electric Mobility Mission Plan (NEMMP) 2020 was launched in 2012 (Department of Heavy Industry, 2012). The NEMMP 2020 targeted a sale of 6-7 million electric and hybrid vehicles (within the category of 2Ws, 3-wheelers (3Ws), cars, buses, and light commercial vehicles (LCVs)) by 2020. It codified the aims of the NMEM and provided a detailed framework for attaining the target it set out.

Building on the NEMMP 2020, the Faster Adoption and Manufacturing of Electric (and Hybrid) Vehicles (FAME) Scheme was launched in 2015 and aimed to generate demand for EVs through consumer subsidy and technology creation. The scheme, initially slated for a period of two years, ran for a total of four years through multiple extensions. Several changes were also made in the scheme during that period, notably the removal of "mild hybrid"[1] vehicles from and the inclusion of battery electric buses in the scheme. Following the wrap-up of FAME scheme Phase I in March 2019, Phase II of the scheme was launched in April 2019 with a higher ambition, more focused scope, and substantially higher commitment of funds. Phase II was primarily aimed at demand creation through end user subsidy and targeted the electrification of public transport, commercial passenger vehicles and 2Ws, with some funding also available for public charging infrastructure development.

Later, in 2019, two supply-side schemes were launched: a Performance Linked Incentive (PLI) scheme for advanced automotive components to support the domestic automotive industry in its transition to electric mobility, and a PLI scheme for advanced chemistry cells that seeks to create a large-scale battery manufacturing industry in India. In 2022, the Government of India announced the National Electric Bus Program (NEBP) that targets a sale of 50,000 electric

[1] A type of vehicle that has an electric motor but no electric-only mode of propulsion.

buses (e-buses) over 5 years (CESL, 2022). Following this, in August 2023, the Government of India announced the launch of the 'PM-eBus Sewa' scheme whereby the national government is providing financial support to the tune of USD 2.6 billion (INR 20,000 crores) towards procurement of 10,000 e-buses in 169 cities (PIB, 2023). This scheme effectively provides financial backing to the NEBP. In parallel, since the creation of the FAME scheme in 2015, several state Governments have come up with their own policies on electric mobility that aim to support the growth of EV manufacturing in their states along with additional consumer subsidies for EV purchase. Figure 1 provides a timeline of major national policies on electric mobility since 2010.

The policy attention has helped increase the sales of EVs over the years, though overall diffusion levels remain low when viewed in terms of percentage of overall vehicular sales, aside from 3Ws (see Figure 2). The very high rate of diffusion within the 3W segment can be attributed to the phenomenal growth of e-rickshaws (see Dutt, 2022a), favourable national policies towards electrification of 3Ws (e.g., FAME II scheme; see Department of Heavy Industry, 2019) as well as reduction in the total cost of operations (TCO) of e3Ws (see Kumar and Chakrabarty, 2020). Relevant to this study is how sales trends vary across different modes, which links with a recurring theme of this study – the process of electrification intersects with the multimodal system of passenger mobility in India, and this intersection throws up some interesting questions and issues, as discussed in the next section.

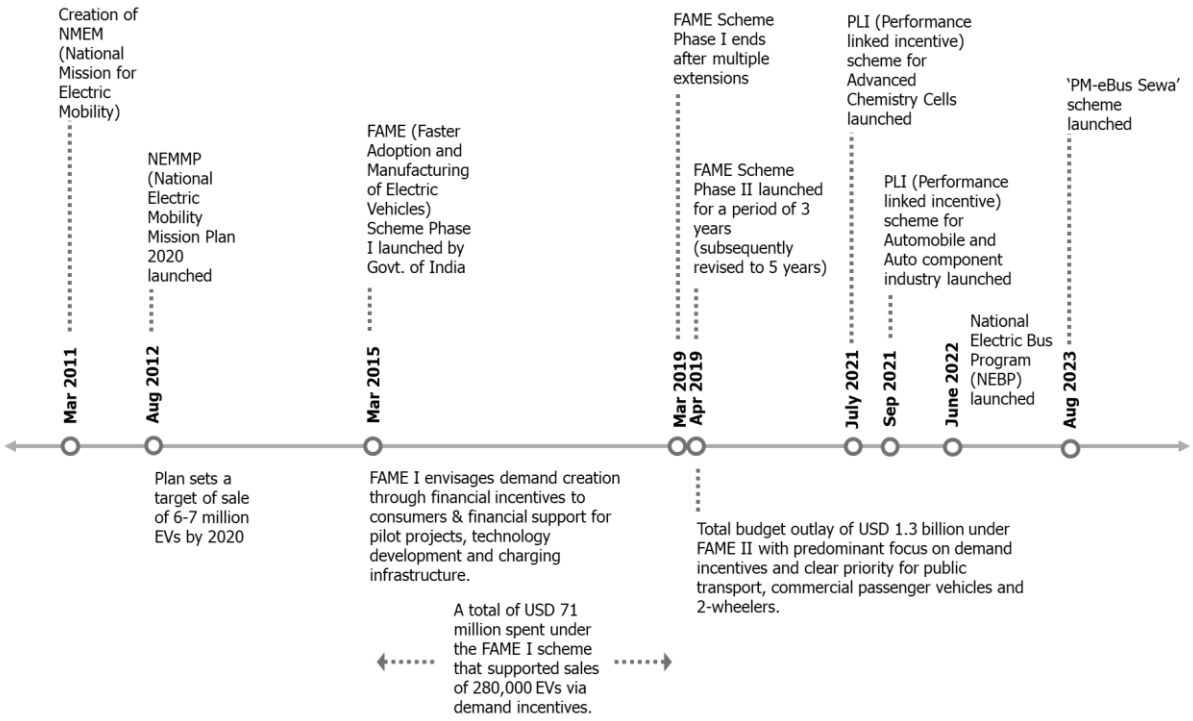

Figure 1: A timeline of major national policies and schemes for promotion of electric mobility launched by the Government of India since 2010

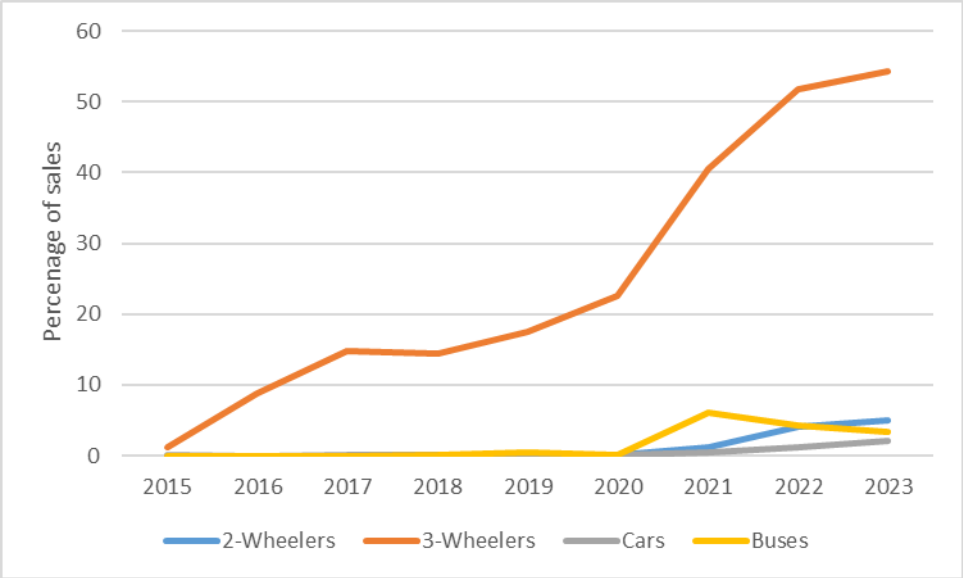

Figure 2: Share of EVs in total vehicular sales across different modes between 2015 and 2023

Source: Clean Mobility Shift (2024)

1.2 The politics of passenger mobility in India

> *"Formulating policy means making choices. Once you do that, you please the people that you favour but infuriate everybody else. One vote gained, ten lost. If you give the job to the road services, the rail board and unions will scream. Give it to the railways, the road lobby will massacre you. Cut British Airways investment plans, they'll hold a devastating press conference that same afternoon."*
>
> *Yes Minister: The Bed of Nails, 1982*

Passenger mobility systems in Indian cities, and in general in cities in emerging economies, are multimodal. The range of modes vary from non-motorized modes (walking, bicycles, and cycle rickshaws) to a wide variety of motorized modes including 2Ws, 3Ws, cars, buses, and metro, with further variations existing within most of the modes. The various modes cater to a wide range of travel demands and different socio-economic strata of society, whereby as a person goes up in the socio-economic hierarchy, the range of modal options available to them tends to increase and their modal preferences typically change in line with their modal aspirations (a schematic representation of this dynamic is shown in Figure 3).

At a basic level, therefore, the modes represent competing interests, with actors around each mode striving for priority, sustenance or even survival of the mode within the system (the matrix of competing interests goes much further than this, as discussed later in this chapter). Politics lies in the process by which trade-offs between these competing interests are resolved (DeSombre, 2020). 'Resolved' here does not imply a permanent or even long-term resolution, but rather a semi-permanent resolution which is subject to constant negotiation and possibly frequent change. This study focuses on the theme of competing interests that manifest at different levels (Figures 3 through 5) and various processes through which the resolution of trade-offs between competing interests plays out.

Figure 3: Schematic representation of the multimodal politics of passenger mobility systems in India

Picture credits: iStock images

Passenger mobility systems are associated with various issues whereby different modes make a differentiated level of contribution to the issues (Figure 4). Starting with carbon emissions, different modes contribute varying amounts of CO_2 per-passenger kilometre of use, with fossil fuel driven cars typically contributing greater amounts than buses, 2Ws, or 3Ws (Ritchie, 2020). Relatedly, each mode contributes through its differential level of fossil fuel consumption in different proportions to issues of energy security and foreign exchange reserves, given that India is primarily an importer of transport fuel. Similarly, modes have different levels of contribution to non-CO_2 air pollutants like Nitrogen Oxides and particulate matter. They also contribute

differently to congestion, whereby single-occupancy cars, for example, disproportionately occupy road space. This in turn contributes to the stress on land and other infrastructure that is created through the building of ever more roads and parking space. Notable here is how cars, more than any other mode, allow low-density suburban living and thereby create conditions for their own sustenance and use (Urry, 2004). Aside from this, public transport systems, semi-or-non-regulated modes, walking, and cycling are key to the ability of lower income sections of society to pursue economic and social activities and are thus critically linked to matters of equity and social justice. Finally, different modes are associated with varying levels of road traffic collisions and the associated fatalities.

The wide range of issues and the varying contributions of different modes to those issues creates a situation where different techniques or interventions can help to address the issues to varying degrees. For instance, a public transport related intervention can potentially help address all issues, though some issues can be worsened depending on the exact nature of intervention, such as when the introduction of a costly metro system in some contexts exacerbates equity issues. Creation of unviable metro systems in smaller cities saps the funds needed for running bus systems that may serve a passenger load 15 times that of the metro at a tiny fraction of the cost of developing and running the metro system (Times New Network, 2017). It has been widely demonstrated how road infrastructure expansion can address issues of congestion in the short term but worsen many other issues (Badami, 2009).

Thus, there are trade-offs involved in adopting different interventions to address competing issues associated with transportation. In other words, there is a politics associated with the selection or adoption of any particular government intervention, such as electrification. This is one of the avenues of interest for this study. Furthermore, any government intervention, even if it targets one specific mode of transportation, invariably takes place in a multimodal system, and may therefore change the relative position of the targeted mode(s) within that system. As such,

the intervention is likely to have implications beyond the mode that is targeted. Thus, another avenue of interest for this study is how electrification intersects with the inherent politics of a multimodal system. Finally, there are competing interests within some of the modes themselves, represented by, in the case of bus systems, actor groups like users (whose interests may include, among others, high service level or low cost of access), operators (e.g., efficiency, profits, high service level, etc.), vehicle manufacturing industry (e.g., profits, market monopoly, etc.), governments (e.g., ideological wins, electoral gains, etc.), etc. (Figure 5). Thus, the third and final avenue of interest for this thesis is the intersection of electrification with the inherent politics of urban bus systems. The next section explains the research questions that emerge from these three avenues of interest.

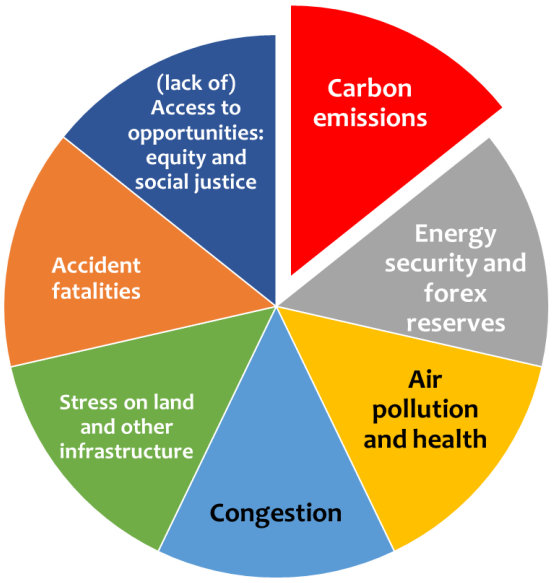

Figure 4: Multi-dimensional problems associated with urban passenger mobility (own elaboration)

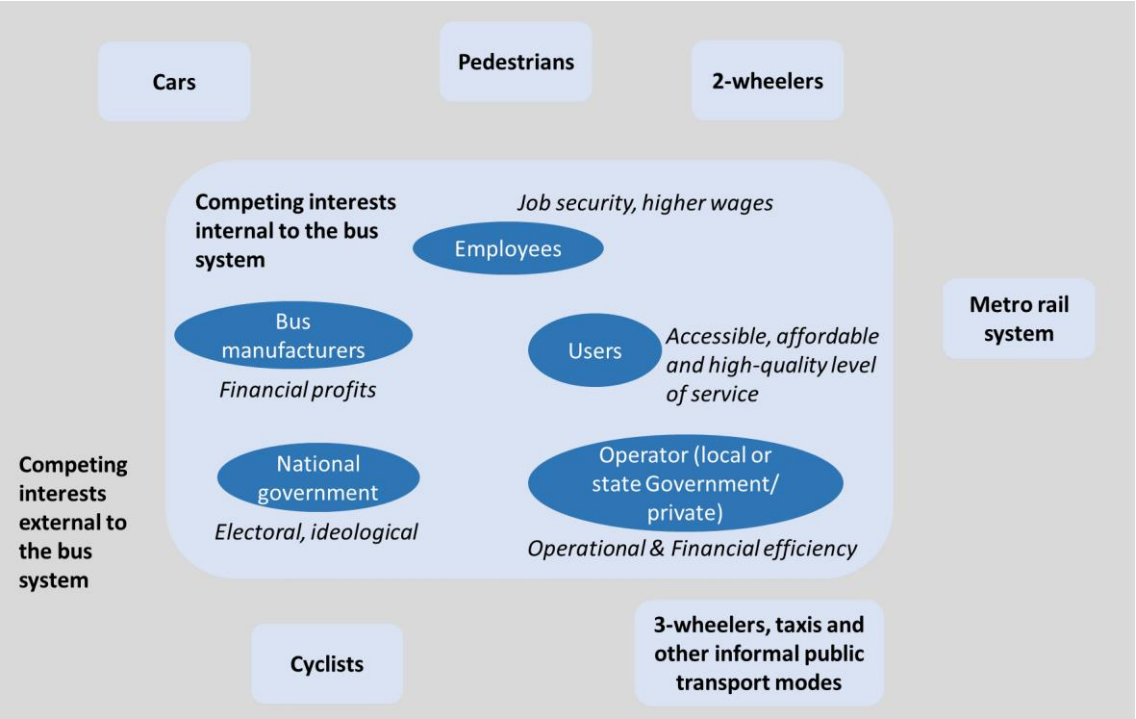

Figure 5: Schematic depiction of competing interests and interest groups for a bus system both within the system and at the multimodal system level

1.3 Research questions

Having laid out the three avenues of interest, I can now explain the three research questions that emerge from them. The first area of interest concerns the selection of electrification as an instrument by the government to ostensibly address issues of air pollution and carbon emissions, but also as a pathway for economic development (as elaborated in Chapter 4). As discussed earlier, the transition to electric mobility has been in a large part driven by national policy, starting with the declaration of the NMEM in 2011. At the time, the EV industry in India was barely existent. Transport policy discourse was dominated by strategies related to public transport expansion and improvement, non-motorized transport, and land use-transport integration. All of these strategies can address a wide range of issues highlighted in Figure 4. The emergence of electrification, which, in contrast, can at best address issues of air pollution and

carbon emissions, indicates trade-offs regarding what issues or concerns related to transportation are being prioritized. These trade-offs become more complicated when the linkages between transport and economic development are considered whereby using a transport intervention to achieve economic goals (such as ramping up India's manufacturing sector by developing the EV industry) can take precedence over using another intervention to alleviate environmental concerns (such as improving public transport systems). Thus, the first research question that this study poses is: how and why were some of the early national policies on passenger transport electrification created?

The second avenue of interest is the intersection of electrification with the politics of multimodal passenger transportation system. At the national policy level, there has been clear evidence of this politics playing out. The FAME I scheme did not prioritize electrification of any mode in particular. The FAME II scheme sought to clearly prioritize electrification of buses, 2Ws, and 3Ws, with the stated reason of focusing government funding on modes used by the poorer sections of society. However, the politics of multimodality is not limited to policymaking. The trade-offs involved in affording priority to different modes are legitimized or challenged by various forms of discourse. News media discourse in particular, helps frame problems in particular ways (Vigar et al., 2011), makes certain voices visible and others invisible, and thus, helps legitimize certain trade-offs while delegitimizing others. This politics gets enacted through the discourse in the present as much as within imaginations of mobility futures that transitions like electrification invariably instigate. My thesis zeroes in on this premise and poses the following research question: Which potential futures for urban e-mobility in India are legitimised by the news media discourse? How are these processes of legitimisation linked to the politics of passenger mobility?

The third and final avenue of interest is the intersection of electrification and the politics of urban bus systems in India. Urban bus systems, at one level, represent a competing interest

within a multimodal system, as discussed earlier. In addition, within the system itself, there remain multiple competing interests represented by actor groups like users, operators, bus manufacturers and national government. Various actors who are part of the bus system constantly make the trade-offs between these competing interests at both levels, with consequences for the state of the bus system. In this context, this study poses the following research question: what changes, if any, is electrification triggering in the politics of urban bus systems in India, and how?

To summarize, this thesis aims to answer the three research questions below that map directly onto the chapters 4 through 6 of this thesis. Figure 6 provides a depiction of how the three research questions link up with different aspects of politics of electrification of passenger transport systems in India.

1. How and why were some of the early national policies on passenger transport electrification created?
2. Which potential futures for urban e-mobility in India are legitimised by the news media discourse? How are these processes of legitimisation linked to the politics of passenger mobility?
3. What changes, if any, is electrification triggering in the politics of urban bus systems in India, and how?

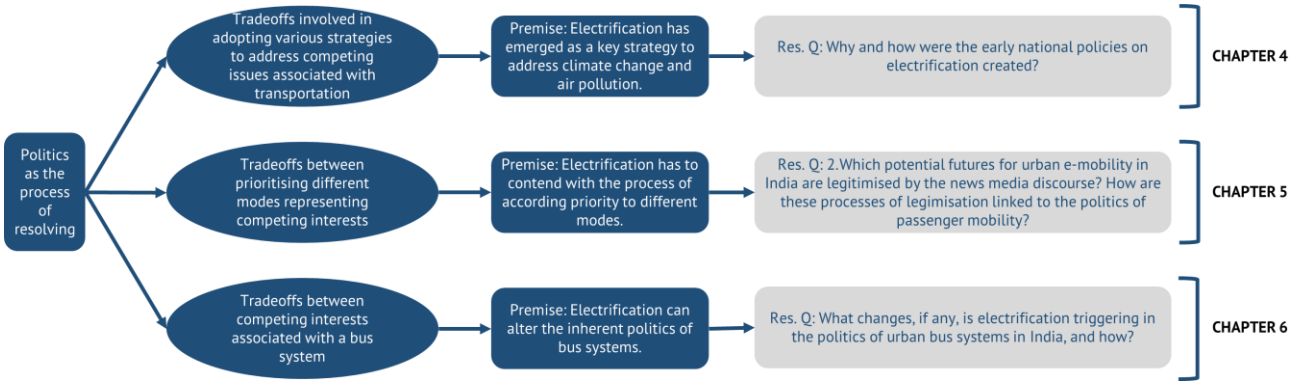

Figure 6: Research questions and their links with the politics of electrification of passenger transport systems in India

1.4 Theoretical framework

The study draws on various theories and literatures that help to situate a study on the politics of transition to electric mobility in India. At a broader level, my study draws upon the sociotechnical transitions (STT) theory and the multi-level-perspective (MLP) framework (Geels, 2002, Geels, 2005b). A 'sociotechnical transition' refers to a process of deep, systemic change in which a period of nonlinear disruptive change moves a sociotechnical system, such as urban bus system, from one meta-stable state to another (ibid.). A sociotechnical (ST) system is a configuration of elements including technology, policy, markets, consumer practices, infrastructure, cultural meanings and scientific knowledge that work together to perform important societal functions like passenger transportation (Geels, 2004). The MLP is a popular framework for understanding ST transitions, and my thesis draws upon the MLP literature in multiple ways, as elaborated in Chapter 2. More specifically, given the nature of my research questions, my work engages with the sub-strand of STT literature that focuses on the politics of transitions (e.g., Dutt, 2022a, Meadowcroft, 2011, Schmid et al., 2021).

My thesis further draws upon multiple strands of additional literature, discussed in more detail in Chapter 2. These include, first of all, the rich and diverse literature on automobility (e.g., Dennis and Urry, 2009a, Paterson, 2007, Urry, 2004), and in particular recent contributions by

Gopakumar (2020) who adopts an explicit political ontology to understand automobility in India. For parts of my research, I also draw upon the conceptual framework of sociotechnical imaginaries (Jasanoff and Kim, 2009, Jasanoff, 2015) that has strong ties with thinking on transitions and their politics although there are also important divergences. Finally, this study also draws upon the multiple-streams-framework and policy entrepreneurship theory (Kingdon, 1984, Mintrom and Norman, 2009) to engage with parts of my research that focus on the politics of policymaking. One of the takeaways from this thesis is its ability to bring together these diverse theoretical frameworks with a view to improving academic understanding of transition politics in mobility systems and possibly beyond. Table 1 summarizes different theories and concepts drawn upon for answering the three research questions over the three papers, with a detailed discussion on the theories and concepts provided in Chapter 2.

Table 1: Different theories, concepts, and literatures employed for answering the research questions

Theories, concepts, and literatures	**Key references**	**Research Question 1**	**Research Question 2**	**Research Question 3**
Sociotechnical transitions, Multilevel Perspective and Transition politics	(Geels, 2002, Geels, 2004, Geels, 2014, Trencher et al., 2021)	✓		✓
Multiple-Streams-Framework and Policy Entrepreneurship	(Kingdon, 1984, Mintrom and Norman, 2009)	✓		
Sociotechnical imaginaries	(Jasanoff and Kim, 2009, Jasanoff, 2015)		✓	
Automobility	(Gopakumar, 2020, Paterson, 2007)		✓	

1.5 Methodology and the impact of COVID-19 on Research Plan

Pre-COVID, the plan had been to conduct in-depth 'elite interviews' in India as the primary data source for the study, with support from secondary data as needed. These semi-structured interviews would be with senior officials (past and present) in various national ministries, state departments and city agencies concerned with the roll-out of electric mobility in India, automobile industry and non-profit organizations and think-tanks working on electric mobility. Various cultural norms surrounding access to government officials in India and the seniority of officials to be interviewed made online interviews not a feasible option. In a similar vein, secondary data required for this study comprised archival documents and internal government files that were often not in the public domain. These two factors made in situ fieldwork critical for collecting the data required for conducting and completing my DPhil research.

Table 2: Types of data and analytical method

Research question	Source of data	Analytical method
Research Question 1	Print news reportage	Critical Discourse Analysis
		Time-series data analysis/ word frequency analysis
		Thematic analysis
	Semi-structured interviews	Process tracing
		Thematic analysis
	Secondary data	Process tracing
		Thematic analysis
		Time-series data analysis
Research Question 2	Print news reportage	Critical Discourse Analysis
		Time-series data analysis/ word frequency analysis
		Thematic analysis
	Semi-structured interviews	Process tracing
		Thematic analysis
	Secondary data	Process tracing
		Thematic analysis
		Time-series data analysis
Research Question 3	Print news reportage	Critical Discourse Analysis
		Time-series data analysis/ word frequency analysis
		Thematic analysis
	Semi-structured interviews	Process tracing
		Thematic analysis
	Secondary data	Process tracing
		Thematic analysis
		Time-series data analysis

Note: Shaded cells indicate the particular source(s) of data used for each RQ and the analytical method used for the said source(s) of data

Having started my DPhil in October 2019, I had originally planned to start fieldwork around August 2020 whereby all of my empirical chapters were to be based on data collected in the field. The onset of COVID-19 in early 2020 precipitated multiple adjustments to my research plans. The primary cause for adjustment was the delay to fieldwork, whose exact magnitude could not be foreseen or predicted at any point. As such, I adjusted my research plans in two ways. I pivoted to using secondary data for one of my chapters (Chapter 5). Thus, Chapter 5

uses archival print news data collected from the NEXIS UK database and employs Critical Discourse Analysis principles to analyse the news media discourse. Having managed to finally leave for field work in September 2021 after a delay of 13 months, I collected secondary data collected from various sources and conducted semi-structured interviews for the analysis in my other two empirical chapters. Various analytical methods have been deployed as suitable and relevant for different parts of the study as shown in Table 2 and explained in Chapter 3.

1.6 Key contributions of the thesis

The overall contribution of my thesis is to demonstrate how the ongoing transition to electric mobility in India is enmeshed within the politics of passenger mobility systems in multiple ways, and how that has profound implications for the understanding of transitions within prevailing scholarship as well as the future of urban (electric) mobility in India. This study seeks to both emphasize the significance of examining India as a site of large-scale ongoing energy transitions in its own right, and also use India as a case study whereby its findings can find application in other geographies (see Section 7.3.1). My work explores in depth some of the ways in which politics manifests and intersects with the ongoing transition. Thus, one of the key contributions is that it helps to understand how the genesis of electrification is rooted within the political economy of passenger mobility. This understanding also helps to expand the STT literature by demonstrating how transitions can be triggered by regime actors acting as policy entrepreneurs who can connect tensions within the regime with landscape developments to discursively construct landscape pressures for the transition. Another contribution is that the study helps to understand the connections between electrification and the politics of multimodal mobility systems and its implications. In doing so, it helps to expand transition politics literature that has not adequately examined the politics of 'whole system' transitions (Geels and Turnheim, 2022). Yet another contribution is that it helps to understand how transitions can alter the inherent politics of a sociotechnical system, by demonstrating how electrification is shifting the politics

of bus systems in India. Here again, it helps to expand transition politics literature that has focused more on the politics of change and less on how system change can influence the inherent politics of the system. These contributions do not, by any means, aim to address all aspects of the politics of electrification in India. Yet, they help to demonstrate why it is pertinent to engage with the politics of electrification, even if in a selective or limited way, whereby future studies can build upon the findings of this study.

1.7 Structure of thesis

The rest of this thesis is structured as follows. The second chapter on Literature Review provides an in-depth review of various literatures and theoretical strands within which I situate my work and to which I seek to contribute. These include the sociotechnical transitions and the associated multi-level perspective framework, transition politics, policy entrepreneurship, sociotechnical imaginaries, and automobility. The third chapter on Methodology lays out the different types of data and analytical methods adopted for my three empirical chapters and the reasoning behind their use. It also explains the process and principles adopted for acquiring data and recruiting interviewees, and the ethical and safety considerations for my field work, given that it happened in between various COVID lockdowns.

The fourth chapter is my first empirical chapter that addresses the first research question. It demonstrates how regime actors helped to discursively construct landscape pressures for transition to electric mobility and created several national policies and schemes during the early years of the transition between 2010 and 2015. The fifth chapter is my second empirical chapter that addresses the second research question. Using the concept of sociotechnical imaginaries, it argues that the transition to electric mobility is being assimilated within the politics of passenger mobility systems in India whereby electrification is being discursively positioned as a pathway towards entrenchment of a growing automobility at the cost of marginalization of other modes. The sixth chapter is my third and final empirical chapter that

addresses the third research question. Using the theoretical frame of sociotechnical regime and rules, it provides evidence of shifts occurring in the politics in ways that are likely to improve urban bus systems and make them more efficient, albeit with considerable caveats and potential implications for just transitions, from the perspective of attaining just outcomes for all (Heffron and McCauley, 2018, Newell and Mulvaney, 2013).

The seventh and final chapter on Conclusions synthesizes the findings from the three empirical chapters into a coherent contribution that my thesis makes towards the scholarly understanding of the politics of transition to electric mobility in India and the relevant literatures within which I situate my work. It also addresses the limitations of my research and points towards further lines of enquiry emanating from my research. A list of references is provided at the end of the thesis.

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview and chapter structure

This chapter reviews different strands of literature within which I situate my research and discusses various theories and concepts that I draw upon for my study. I start in Section 2.2 with a review of the extant literature on transition to electric mobility in India and identify the gaps therein, specifically the lack of studies within the research tradition of sociotechnical transitions to which I seek to primarily contribute with my work. To substantiate this point, in Section 2.3 I examine three approaches to theorizing passenger transportation as a system – i.e., automobility, sociotechnical systems, and technopolitical constellation and their associated theories of system change. Here, I make the case for situating my work largely in sociotechnical transitions (STT) theory that is premised on sociotechnical systems, whilst also drawing upon the technopolitical constellations (TPC) approach.

Thereafter, I proceed in Section 2.4 by identifying the multi-level-perspective (MLP) framework, one of the strands of the STT theory, as suitable for my research and offer my reasons for it. I discuss the MLP in depth and highlight its relevance for my study. Here I revisit the TPC approach and discuss how I and why I situate myself in between the two approaches (MLP and TPC) for my study. Following this, in Section 2.5, I discuss two lines of criticism of the MLP framework: insufficient attention to politics of transitions, and the under-theorisation of landscape pressures. I situate my work in the sub-strands of MLP literature that have emerged in response to these two criticisms. I review these sub-strands of MLP literature, identify gaps therein, and discuss the contributions that my work makes to them.

Hereafter, I proceed to discuss two separate, but not unrelated to MLP, bodies of literature upon which my research draws to make these contributions: policy entrepreneurship in Section 2.6 and sociotechnical imaginaries in Section 2.7. I conclude this chapter with a discussion in Section 2.8 on the inter-connections between the different bodies of literature upon which my

work draws and to which it contributes. I signpost my research questions throughout the chapter insofar as they relate to different strands of literature, concepts and theories discussed here.

2.2 Transition to electric mobility in India

A rudimentary search on the SCOPUS platform for publications on electric mobility in India reveals scholarly attention to this ongoing transition has increased substantially since 2015 when the FAME Phase I scheme was notified in India. In other words, there appears to be a co-relation between the growth of scholarly work on electric mobility in India and the introduction of national policies and schemes on electric mobility. The years 2015-2022 account for 90% of all articles that have India or Indian in their article title *and* electric mobility or its synonyms in the article title, abstract or keywords. For publications on electric mobility globally, the corresponding figure for 2015-2022 is around 68%.

Systematic literature reviews for studies on transition to electric mobility in India do not exist yet, certainly none that look at research across different traditions. Nevertheless, it is evident that a very large strand of extant literature takes a techno-economic view of the transition. Within this tradition, electrification is essentially considered a matter of substituting the energy source and propulsion systems of vehicles in a manner that is technologically and economically feasible, and its impacts are considered quantifiable. Examination of an ongoing transition within this tradition quite often reduces the enquiry to deterministic notions of 'constraints' or 'barriers' and 'enablers'. For instance, Digalwar et al. (2022) analyse 74 factors associated with uptake of EVs in India, classify them into twelve categories, rank them in terms of importance using a survey of 902 respondents, and conclude that awareness creation is the most crucial factor towards mass adoption.

Other concerns within this tradition include quantifying the impacts of electric mobility on India's climate commitments and air quality needs (e.g., Hossain et al., 2023), implications of

EV transition for India's oil imports and foreign exchange reserves (e.g., Rajagopal, 2023) or determining the requirement of charging infrastructure and methods of its deployment (e.g., Veerendra et al., 2022). Within this tradition, attention to social dimensions of the transition is often limited to understanding linkages between behavioural patterns of consumers and take-up of EVs (e.g., Shalender and Sharma, 2021), or the relationship between government policies and growth of electric mobility (e.g. Joshi et al., 2022).

This body of literature offers valuable insights into how the transition to electric mobility can be accelerated and the management of its impacts. My research interests, however, lie in the broader issues of how and why electrification has been unfolding and its interrelationship with the configuration of passenger mobility and its politics. Examination of these issues demands an approach that understands technology to be embedded within society, such that electrification can get shaped by and shapes various dimensions of society. Such an approach pays attention to the role of politics, discourse, political economy, and governance in transitions.

These aspects have been well attended to within the tradition of sociotechnical transitions, in which some literature on electric mobility in India has started to emerge recently (see Dutt, 2022a, Dutt, 2022b, Dutt, 2023 and subsequent sections for a discussion on these papers' contributions). This approach is in turn grounded in a wider scholarly tradition that takes a holistic or systems view of transportation, such as automobility (Urry, 2004), sociotechnical systems (Geels, 2012) or technopolitical constellations (Gopakumar, 2020). The next section elaborates on the scholarship on these approaches.

2.3 Systems approaches to understanding passenger transportation

Automobility is one of the systems approaches to passenger transportation that has come from scholarship examining the dominance of cars in western European and northern American

societies[2]. Building on complexity theory, Urry (2004) argues that an automobility system comprises six components that in unison create a unique kind of domination, whereby the interaction between the components creates a larger system effect, and generates the preconditions of its own expansion (Dennis and Urry, 2009b, Urry, 2007, Urry, 2008). These components are the car as:

- a significant manufactured object in history and its relationship with 20th century capitalism and economic growth through the emergence of concepts like Fordism (see Paterson, 2007)
- a major item of individual consumption and its symbolic connotations linked to prestige, progress, freedom, masculinity, and identity (see Butcher, 2019, Edensor, 2004)
- a uniquely powerful industrial complex given its linkages with other industries like car parts and accessories; fossil fuel extraction, refining and distribution; roadbuilding and maintenance; hotels, roadside service areas and motels; car sales and repair workshops; suburban house building; retailing and leisure complexes; advertising and marketing; and urban design and planning (Freund and Martin, 1993)
- the predominant form of 'quasi-private' mobility that subordinates other mobilities of walking, cycling, travelling by rail and so on, and reorganizes people's choices in respect of where they live, work, go for leisure, etc. (Whitelegg, 1997)
- the dominant culture that sustains major discourses of what constitutes modernity and the good life (see also Braun and Randell, 2022)
- a unique category of artefact with extraordinarily detrimental impacts on earth's resources and environmental quality (see also Leimbach et al., 2007)

[2] There is also a Foucauldian scholarship on automobility, that conceives it as an ordering regime, whereby the automobile becomes a tool for exercise of power and regulation of behaviour of individuals, through mechanisms such as traffic regulations and licensing systems (cf. Bærenholdt, 2013). However, that is not relevant to my work.

Sociotechnical (ST) systems is another popular formulation that comes from innovation studies and is aligned with Urry's conception of automobility (Schwanen, 2015). A sociotechnical system is a configuration of elements including technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge that work together to perform important societal functions, such as transportation (Geels, 2004).

Given the origin and preponderance of literature on automobility and sociotechnical systems in western Europe and northern America, there remain questions over the import of these theoretical frameworks in the contexts of emerging economies such as India. A key difference lies in the multimodal nature of transport systems in emerging economies like India in contrast to the car-dominated societies in many developed economies. For example, India had 19 cars per thousand population in 2015, in comparison to 478 cars in the United Kingdom and Netherlands and 551 cars per thousand population in Germany in the same year (OECD, 2023, Paladugula et al., 2018). However, while the absolute population of cars and their modal share in trips in cities may remain low, they still top the aspirational mode of mobility in India (Nielsen and Wilhite, 2015). Thus, while India may not possess the type of complete domination by cars as explicated by Urry (2004), there is a constant strife to have that, making passenger mobility in cities a site of contestation and politics.

Building on the distinction above, Gopakumar (2020) identifies automobility in Indian cities, using Bengaluru as a case study, as a technopolitical constellation – a complex, multidimensional socio-material entity that enrols not just automobiles, but a range of other technological, material, social and historical elements to enact specific political goals, including the privileging of the movement of those inside cars. Such a conceptualisation of automobility brings to centre the role of politics in cars becoming the dominant mode within the passenger mobility system. One key point Gopakumar makes is that automobility in Indian

cities is still emerging and remains constantly contested. To an extent, this is different from cities in developed economies where automobility has a longer legacy of land-use configurations that lead to the kind of lock-in that continues to create the conditions for expansion of automobility (e.g., Jones and McCreary, 2022). While this legacy and lock-in in part contributed to a functionalistic understanding of automobility as a stable sociotechnical regime (see Geels, 2012), automobility has come to be contested more strongly within developed economies in the 21st century, not least because of concerns over climate change, air pollution, public health and liveability (e.g., Baehler and Rérat, 2022, Ruhrort, 2023).

Gopakumar (2022) argues that, in cities like Bengaluru, the technopolitical constellation of automobility is installed in three ways that imbue it with considerable political power. These are the construction of a 'regime of congestion', the assemblage of 'infrastructurescapes' and the composition of an 'automobile citizenship'. The 'regime of congestion' is a structure of decision making that has an explicit political aim of physical and discursive occupation of the street space by the private automobile at the cost of poorer inhabitants of the city. 'Infrastructurescapes' are sociotechnical webs that help infrastructure, actors and actor-coalitions and discourses coalesce into heterogenous assemblages. They are embedded with privileged normative orientations and laden with power and purpose of shaping the experience of mobility of people in a way that is neither environmentally sustainable nor equitable. 'Automotive citizenship' is a durable phenomenon whereby drivers, redesigned street-side artefacts, social media platforms and traffic management policies help the continuous social privileging of automobile travel in the city, thus enfranchising an automotive public and disenfranchising the non-automotive publics who find themselves excluded at multiple levels and in various ways.

In essence, the main insights that various conceptualizations of automobility discussed in this section offer are that technology is deeply embedded within society, that there are various ways

to understand how this plays out within different socio-geographic contexts, and that change typically happens at a systemic level. These insights are fundamental for my research. For my work, I draw upon both the technopolitical constellation framing as well as a particular strand of the STT theory, the multi-level perspective (MLP). I discuss this and the MLP in the next section.

2.4 Sociotechnical transitions and the Multi-Level Perspective

The sociotechnical transition concept emphasises that a 'transition' within a sociotechnical system such as passenger mobility involves much more than merely the diffusion of a new technology, a classic example being the transition from horse-carts to automobiles (Geels, 2005a). 'Transitions' are the result of co-evolving processes in economy, society, ecology, and technology that progressively build up toward a revolutionary systemic change on the very long term, which in turn makes it impossible to predict, fully comprehend, or steer transitions directly (Loorbach et al., 2015).

The notion of 'sociotechnical transitions', thus, goes beyond other alternative approaches such as those of neoclassical economists (societal or environmental problems can be solved by internalising the market externalities in the pricing mechanism, such as congestion charging), psychologists (influencing aggregate behavioural change through change in attitudes), deep ecologists (subscribing to a new societal paradigm such as the 'degrowth ideology') and engineers and industrial ecologists (aiming to address all problems with technological solutions) (Geels, 2012). A related term, sustainability transitions, refers to a gradual shift to more sustainable form of production and consumption in these systems, thus introducing a normative dimension to the change (Markard et al., 2012).

Since the late 1990s, four approaches to understanding sociotechnical transitions have emerged. These are the multi-level-perspective, strategic niche management, transition management and technological innovation systems (see Köhler et al., 2019, Markard et al., 2012 for a review of these various approaches). Of the four, I situate my work within the MLP

literature as the MLP has become a core framework for analysing sociotechnical transitions (Sovacool et al., 2020b) and therefore helps me speak to a wide body of literature.

The MLP argues that transitions are non-linear processes that result from the interplay of multiple developments at the three levels of a sociotechnical system: regime, niche, and landscape (Geels, 2002). The regime constitutes the set of rules that provide orientation and coordination to the activities of relevant social groups (engineers, policymakers, users, civil society, etc.) that together keep a sociotechnical system stable (Geels, 2005b). Geels (2004) categorizes three types of rules: regulative rules, such as emission standards, which are explicit formal rules that restrict behaviour and govern interactions; normative rules, encompassing values, norms, rights, duties, and expectations, which are internalized through socialization (e.g., society's cultural values); and cognitive rules, which shape how individuals interpret and understand their reality (e.g., the symbolic meanings of technologies, user practices, and preferences). This categorisation remains widely used until this day (e.g., Colovic et al., 2025, Käyrä and Kuhmonen, 2024) and is also used in Chapter 6 of this thesis. Notably, while the regime is considered to account for the stability of ST systems, it does not imply an absence of tensions within the regime. As Bavinck (2020) demonstrates through the case of transition to ring seine fishing in India, some of these tensions can be systemic and prolonged, creating a transition that may be unstable or disputed. I return to this theme of regime tensions in Chapter 4.

Niches are protected spaces where radical innovations emerge and develop through experimentation and visioning and eventually become capable of reconfiguring the regime (Smith and Raven, 2012). These spaces allow the innovations to be sheltered from mainstream competition and are crucial for transitions as they provide the seeds for systemic change (Geels, 2012, Schot and Geels, 2008). The landscape is the combination of wider contexts and developments over which regime actors have little influence, such as demographic shifts,

economic crises, climate change, political economy, etc. (Geels, 2005b). Within MLP literature, both the landscape concept and the ways in which landscape pressures unfold have received much less attention than conceptualisations of, and developments related to, the niche and regime (Kivimaa and Sivonen, 2024, Morone et al., 2016). This is an important aspect for my first empirical chapter, and I discuss this in Section 2.5.

Within the classic formulation of MLP, a transition occurs when niche innovations are able to make use of opportunities created by destabilisation caused in a regime through pressure from the landscape. If niche-innovations have had time to mature, regime destabilisation can allow them to challenge and disrupt that regime, resulting in either its displacement or its fundamental reconfiguration. Furthermore, the transition can happen through various pathways depending on the timing and nature of the interactions between the three levels, which go beyond the classic formulation that has been referred to as technological substitution within a typology of pathways (Geels and Schot, 2007) (see Table 3 and Geels et al. (2016) for a reformulation and differentiation within this original typology of pathways).

The MLP has been a popular framework for analysing mobility transitions. It has been used for analysing historical transitions, such as horse carriages to automobiles (e.g., Geels, 2005a), as well as ongoing sustainability transitions (e.g., Trencher et al., 2021). It has been used for analysing multiple forms of transport systems and innovations, such as electric mobility (e.g., Lin and Sovacool, 2020), bus rapid transit system (e.g., Fryszman et al., 2019), hydrogen fuel cell vehicles (e.g., Müller, 2024), cycling (e.g., Becker et al., 2022), shipping (e.g., Lee et al., 2024), and aviation (e.g., Kim et al., 2019). It has also been applied for studying mobility transitions at different scales, ranging from city (e.g., Ghosh and Schot, 2019), region (e.g., Haley, 2015), national (e.g., Geels, 2018), as well as transnational scale (e.g., Machado et al., 2022). Finally, while a lot of studies have been carried out in the context of advanced economies, such as western Europe (e.g., Geels, 2018), there has been growing attention to

mobility transitions in east Asia (e.g., Trencher et al., 2021), South America (e.g., Fryszman et al., 2019), south east Asia (e.g., Sunio et al., 2019), as well as South Asia particularly in the Indian context, as discussed further.

Dutt (2023) has deployed the MLP to examine the fast growth of the electric 2Ws niche in India, which remains one of the major developments of India's ongoing transition to electric mobility. He discusses the significance of landscape pressures such as rising fuel prices, growth of an entrepreneurial ecosystem and developments in battery technology in spurring the transition, while advocating the need for policies to destabilize the ICE 2Ws regime for the transition to accelerate further. In particular, he notes the strong influence of national policy in helping the niche develop and grow. However, his work does not delve into the politics surrounding the early national policies (2010-2015) that triggered the transition, which remains a gap in literature. Furthermore, examining the cases of transition to CNG (compressed natural gas) and electric rickshaws in India, Dutt (2022b) shows how a range of actors such as the judiciary, civil society groups and citizen activists, that are difficult to categorize as belonging to the niche or regime, can fill in the gap left by a strong and active state, and push or pull the transition in different directions depending on their motivations and resources.

Dutt's works contribute to a larger growing body of literature on sociotechnical transitions in India, including mobility transitions. Through a detailed sociotechnical analysis of changes in regulative, cognitive, and normative rules within multiple public transport regimes in Kolkata over a period of 15 years, Ghosh and Schot (2019) theorize three types of regime change: optimization, transformation, and transition. Within the cases of optimization and transformation, they argue, regime change can be brought about by regime actors without an existing niche. The prominent role of regime actors within the government in bringing about a transition is emphasized by Dutt (2023) in the case of electric 2W niche creation discussed earlier and is also seen in other sectors. For instance, Rajagopalan and Breetz (2022) show how

the national government as a regime-level actor initiated the development of off-grid solar for rural electrification, leading the way on innovation, experimentation, and niche creation. My first empirical paper also engages with the role of regime actors within the national government in triggering the transition to electric mobility in India.

Table 3: Typology of socio-technical pathways (Source: Geels and Schot, 2007)

Transformation	**Reconfiguration**	**Technological substitution**	**De-alignment and re-alignment**
New regimes grow out of old regimes through cumulative adjustments, as niche developments are not sufficiently developed to take advantage of landscape pressures	Similar to the transformation pathway, new regimes grow out of older regimes but with substantial changes in the overall architecture of the regime (technical changes, changes in user practices, etc.) due to integration of niche developments that have a symbiotic relationship with the regime but end up triggering wholesale changes gradually	Niche developments are sufficiently developed and go on to change the existing regime once there are substantial pressures from the landscape	Substantial pressures from the landscape lead to destabilisation and erosion of the regime, and with no clearly developed niche, competition occurs between multiple niche innovations until one of them dominates and forms the basis for the realignment of a new regime

An expansion of the MLP framework, the conception of whole systems, is relevant to my work as my research engages with the whole system dynamics of passenger mobility particularly for the second research question. The term 'whole systems' is used in different ways, such as in cross-sectoral multi-system approaches (e.g., Martiskainen et al., 2021), but I understand a whole system as one that comprises multiple adjacent regimes, niches and landscape pressures, all related to a the delivery of a common societal function (see Geels, 2018, Geels and Turnheim, 2022). Passenger mobility is such a case of a whole system comprising multiple regimes like

automobility, bus, metro, scooters, walking, cycling, taxis, rickshaws, etc., along with multiple niches such as electric cars, electric buses, electric hybrid cars, biofuels, or autonomous cars, as well as different landscape pressures such as climate change, air pollution and energy security. Within this conception of a whole system, it is possible that one or more regimes may be dominant and render the others subaltern, such as typically in the case of automobility and other transport regimes within the passenger mobility whole system (Geels, 2012). The mechanism behind this dynamic can vary across geographies, and different perspectives can be useful to understand that (see below). From the MLP point of view, the concept of whole system serves to underscore that these systems can undergo a sociotechnical reconfiguration, whereby multiple regimes can change at different speeds, degrees, and in different ways, whereby the dynamic between the regimes can change over time too (e.g., automobility could get less or more dominant) (Geels, 2018).

Given that I draw upon both the MLP and technopolitical constellation approaches, it is useful here to revisit the differences between the theories of system change offered under the conceptualization of automobility as a complex system (Urry, 2008), as a technopolitical constellation (Gopakumar, 2020) and as a sociotechnical system just discussed above (Geels, 2012) (see Table 4). Urry's theory of system change is grounded in complexity theory and the notion of tipping points, where small interdependent transformations occurring in a particular order can tip a system such as automobility onto a new path. He outlines a range of such small technical, economic, policy and social changes, such as new fuel systems, new building materials for car, smart information and communication technologies and shared car ownership, which if occurred in a particular order, that he argues is difficult to predict let alone create, could lead to a post-car society (Urry, 2008). While useful towards understanding how an emerging automobility may take hold in India by creating pre-conditions for its own expansion, in the context of my research, Urry's theory of change has limited relevance given the focus of my research questions.

I use Gopakumar's conceptualization of technopolitical constellations to inform my understanding of passenger mobility within India as a deeply contested and political site. This implies that any process of change within this system cannot be devoid of or understood without attending to this politics, and I take this on board for the purposes of my study.

Table 4: Comparing different perspectives on automobility and their theory of system change

Analytical dimension	Automobility as a complex system (Urry)	Automobility as a sociotechnical system (Geels)	Automobility as a technopolitical constellation (Gopakumar)
Ontological perspective	Automobility a product of the interconnections between various elements	Automobility a configuration of different elements (technology, policy, markets, consumer practices, infrastructure, cultural meaning, and scientific knowledge) that are co-constituting and co-evolving with each other and fulfil a societal function.	Automobility a result of power relations, politics, and governance structures
Epistemological foundations	Complexity theory	Social construction of technology	Critical social theory and political science, Science and Technology Studies
Theory of change	Tipping points, whereby small changes in one part of the system can lead to big changes across the system	Through the interplay of activities across three levels of landscape, regime, and niche under the MLP framework	Empowering subaltern technopolitical constellations around walking, cycling, etc. that could lead to the displacement of automobility.
Relevance for my work	Ideas around automobility's ability to create preconditions for its own expansion useful to understand	The MLP offers flexibility to understand sociotechnical transitions, and room for adaptability in different	Helps inform the view that within a whole system context, preferential electrification of

	how an emerging automobility may take hold in contexts like India.	contexts. Whole systems framework offers a way to understand the differing dynamics of transitions across different modes within the passenger mobility system.	modes other than cars may require activation of technopolitical constellations

Gopakumar's theory of change is predicated on empowering subaltern technopolitical constellations around modes other than car (e.g., walking or cycling) with the aim of dislodging an emerging automobility. This does not offer substantial insights into transitions in passenger transport that may be driven by sociotechnical innovations such as electrification, which is the MLP's strength.

Without attempting to delve into a debate over potentially deeper ontological differences between the MLP and the TPC approach (the latter would fall within 'relational approaches' as explained by Geels (2010)), it is helpful to acknowledge here some of the ontological tensions between these two frameworks. At the base level, both approaches emphasize the inseparable nature of technology and society. Where they diverge is in the emphasis in Gopakumar's work on different ways in which automobilities in emerging economies are being installed through an outright exercise of power, such that the installation itself becomes a political project. The concept of a sociotechnical regime, on the other hand, offers a more functionalistic understanding of automobility being in a dynamically and comparatively stable state on account of alignment of regulative, cognitive, and normative rules governing the actions of actors that connect different elements of the automobility sociotechnical system. Nonetheless, this divergence is not always very large given the heterogeneity of MLP research. Some authors have adopted a more politics-centric perspective to transitions whilst explicitly positioning themselves within the MLP tradition. Rosenbloom et al. (2016), for instance, start from the premise that "transitions are an inherently political enterprise" (p. 1276) and combine the MLP

with discourse studies in order to analyse how the formation of 'storylines' aids in certain niche-innovation to prevail and mature over others.

For my research, I situate myself somewhat halfway between the MLP and Gopakumar's approach. I start with the whole system framework of viewing passenger mobility comprising various modes, as I believe it is compatible with both the interpretations. I borrow the analytical framework of niches, regimes, and landscape, for it is a useful starting point to analyse sociotechnical innovation-based transitions and helps me speak to a wide body of literature. However, adopting a position that somewhat resonates with Rosenbloom et al.'s (2016) politicised view on transitions, I argue that the individual systems around the passenger modes are being kept dynamically stable through implicit or explicit political acts that are helping align various sets of rules with the aim of keeping automobility dominant and other modes subaltern. Therefore, within a whole system framework, a sociotechnical innovation could get either assimilated within the politics and serve to further the project of installing automobility or alter the politics that could change the subaltern position of some of the modes.

The next section discusses various sub-strands of the MLP literature with which my work specifically engages. These sub-strands have emerged in response to various criticisms of the MLP, as discussed below.

2.5 Criticisms of the MLP: transition politics and the under-theorisation of landscape pressures

Multiple criticisms have been levelled at the MLP framework and, in response, the framework has evolved and expanded over the last two decades (see Geels, 2011, Geels, 2019 for a summary of these criticisms). Of these, there are two lines of criticism and associated responses that are particularly pertinent to my research. The first relates to the politics of sociotechnical transitions and how they have been addressed and examined in extant literature.

The second line of criticism relates to the under-theorisation of landscape pressures. This section discusses these two lines of criticisms.

2.5.1 Transition politics

Early criticisms about a lack of attention to politics of transitions (e.g., Meadowcroft, 2009, Smith and Stirling, 2010) were followed by a growth in literature on that subject, with a recognition that transitions involve politics by their very nature (Avelino et al., 2016). Sociotechnical systems are invariably associated with capital, electoral, ideological, and indeed individual interests. Any change in the system is likely to trigger a change in the status quo of these wide-ranging interests. For example, a transition to electric mobility affects the capital interests of oil companies and diesel/petrol car manufacturers, electoral interests of political parties seeking to establish new battery manufacturing sites in their constituencies, ideological interests of those that are opposed to state interventions on environmental grounds, and individuals who may not be keen to adjust their behavioural patterns to the demands of EVs. Transitions, therefore, are invariably associated with tensions, resistance, and tradeoffs, making them inherently political. This politics can be understood using different approaches that focus on power relationships, political economy, the role of discourses, and using insights from political science, of which the approaches focusing on the role of discourses and insights from political science are most relevant for my work, as discussed below.

Power relations has been a prominent lens for examining transition politics given power's key role in shaping the processes and outcomes of transitions. For instance, using the case of the UK's electricity system, Geels (2014) shows how various instrumental, discursive, material and institutional forms of power and resistance have been used by incumbent regime actors to resist environmental pressures and fundamental system change. A lens of power relations could illuminate interesting aspects of the transition to electric mobility in India, such as the change in degree of influence the central government has over urban transport matters or the

influence of various actor groups (existing ones such as ICE vehicle manufacturers and new entrants such as EV manufacturers and charging infrastructure providers) in transportation policy making. However, I do not find power relations as an appropriate lens to address my research questions, such as, understanding the political dynamics behind the creation of early national policies on electric mobility. These can be better understood by borrowing insights from political science, as I discuss later.

A political economy lens has also been frequently employed given that transitions are usually deeply embedded within the complex relationships between the state and capital (Zhang and Andrews-Speed, 2020), and often lead to winners and losers (Newell and Phillips, 2016). In particular, attention has been given to the political economic configuration of the incumbent regimes and its effect on transitions. For instance, Brauers and Oei (2020) argue that strong links between coal corporations and the government in Poland, with most coal corporations being majority state owned and unions being heavily involved in political decisions, protect the vested interests of the coal regime and provide resistance to a transition. This line of argumentation serves to highlight that it is difficult to challenge a configuration of economic and political interests woven around an incumbent regime that has been stabilized over a long period, particularly in the domains of energy systems (such as coal or fossil fuel). Just as a niche innovation does not have a regime-level alignment of rules favouring its growth, it also typically does not have a political economic configuration that could enable its development. Yet, niche innovations can come with promises of future political economic configurations that can be deemed favourable by the incumbent regime actors who can then act to deliberately empower the niche. For example, the transition to electric mobility in China was driven by state actors who realised that their ICE car industry would never catch up with the German, Japanese, and American manufacturers but EVs could offer them a pathway to become the global leader in the transportation industry (Lyon, 2024). I revisit this theme in the context of the findings of my first empirical chapter in the conclusions chapter (Section 7.3.3).

Furthermore, recognising the important role of discourses in framing problems and shaping and legitimizing transition pathways, many studies have employed different discursive approaches to study transition politics (Isoaho and Karhunmaa, 2019). Examining the stability of centralised and decentralised urban water management regimes in India, South Africa, and the U.S., Heiberg et al. (2022) argue that discourses, including media discourse, can reflect patterns, dynamics and strategies through which sociotechnical configurations may develop, align, stabilize or get challenged by incumbents and supported by proponents of sociotechnical innovations. In the case of India, they find that both centralised and decentralised systems co-exist to deliver urban water services to different sections of society. Rosenbloom et al. (2016) used discourse analysis to develop a politically informed perspective of transition to solar powered electricity in Ontario, Canada by focusing on the ways in which actor groups at different levels of the MLP strived to shape innovations through narrative construction and how those narratives were crafted through the actors' capacity to connect the content and context of an innovation. Markard et al. (2021) examined the struggles of two discourse coalitions, groups of actors coalescing around a narrative or storyline to influence the process of change, over coal phase-out in Germany and the various concessions that the pro-coal lobby was able to obtain despite the enactment of the phaseout. For my work, I use Critical Discourse Analysis (Fairclough, 1989) to examine the deeper social, economic, and political structures that influence and are reflected in the discourse. I discuss this in more detail in the fifth chapter.

Other studies have borrowed different insights from political science to examine the politics of transition dynamics. Friedman and Rosen (2022) examined the role of policy entrepreneurs, individuals who take advantage of windows of opportunity invest their resources in bringing policy ideas to fruition, who were placed in the government as engineers, architects and planners in engendering a transition to green buildings in Israel. Markard et al. (2016) studied the role of advocacy coalitions, groups of policy actors that share similar belief systems and collaborate and coordinate their actions to help translate their belief systems into policy

outputs and objectives, in shaping the energy policy of Switzerland. Sovacool et al. (2020c) examined the role of transition intermediaries, agents that connect different groups of actors involved in transitions processes and their skills, resources and expectations, in driving sustainable energy and mobility transitions in different European countries. Advocacy coalitions and transition intermediaries are not relevant concepts to employ for my first research question where I examine the dynamics of policy creation on electric mobility in early years of the transition. The actors engaged in creating the policies over a span of 7-8 years did not all act in unison, even though they may have shared some belief systems, hence cannot be considered an advocacy coalition. They can also not be considered transition intermediaries as most of the actors I studied were centrally associated with creating the policies themselves. Policy entrepreneurship is an appropriate conceptual lens to evaluate their role, and I return to this in Section 2.6.

Against this overview of transitions politics literature, it is useful to draw out my approach and the different themes of transition politics with which my work engages. As explained in Chapter 1, I understand politics as the process through which trade-offs between various competing interests associated with a ST system are resolved temporarily and iteratively within a context of limited resources (DeSombre, 2020: p. 24). Such an understanding provides a suitable overarching lens for all my research questions. It also remains sufficiently broad-based to allow me to focus on different themes of the politics of electric mobility, which, for example, a lens of power relations may not allow me to do. Thus, my first research question resonates with a frequent theme of transition politics literature, i.e., the role and strategies of transition actors guided by different interests and ideas in enabling or resisting regime change.

My second and third research questions address a thematic gap whereby there has been a lack of attention to how system change intersects with the inherent politics of sociotechnical systems. By ‘inherent’ politics, I refer to the configuration of interests that may not be entangled

with either enabling or resisting system change specifically, and where the process of making trade-offs between competing interests predates and exists independently of system change. For instance, contestations between various actor groups (national government, state government, private bus operators, etc.) surrounding increased involvement of the private sector in the operations and maintenance of urban buses predate the transition to e-buses (a historical overview of various attempts at engaging the private sector in urban bus operations in different parts of India can be found in Parashar and Dubey, 2011). Actor groups positioned on either side of this contestation do not either favour or oppose the transition to e-buses on account of their predisposition towards privatisation of urban bus systems. Yet, electrification may trigger substantial shifts in the dynamics surrounding the privatization of urban bus systems (see Chapter 6).

Attention to this aspect of transition politics can enable the examination of, for example, how electrification intersects with the politics of different passenger modes or the politics of overall multimodal passenger mobility systems in emerging economies like India. This resonates with my second and third research questions. Indeed, there have been calls to address gaps in transition politics literature relating to mobility transitions and emerging economies (Schmid et al., 2021). Some recent work by Dutt (2022a, 2022b) has begun to fill this gap. In these two papers, he analyses the complex and messy politics of electric rickshaws in India that went from unregulated growth to a phase of vilification to finally being accommodated within the regulatory framework as a result of electoral politics. However, more attention is perhaps due to the politics concerning vilification of e-rickshaws than what Dutt offers to enable an examination of how a phenomenal pace of electrification in a mode can be vilified while in parallel the national policy and governance framework is being geared up to enable a transition to electric mobility. It indicates there may be politics related to the multimodal passenger mobility system that intersects with electrification, one that warrants a closer examination, as

Chapter 5 offers. The understanding of politics that I have adopted helps undertake this examination.

My study also focuses on the connections between regime rules and the inherent politics of sociotechnical systems. Here, it is relevant to point out Kok's (2023) contention that the MLP literature has paid significantly less explicit attention to the ways in which structure (and its different interpretations including, but not limited to, regime rules) is linked with the politics of transitions, in comparison to the connections between agency and transition politics. Without taking a structuralist view of politics (see below), I argue that regime rules are key to the process by which various trade-offs between competing interests are resolved. Therefore, an examination of changes in rules within the context of a ST transition can lend insights into changes in the process by which trade-offs are made and offer a basis for understanding the changing politics of the ST system (see Chapter 6).

I contend that the relationship between rules and trade-offs manifests in three distinct ways. Firstly, regime actors directly negotiate trade-offs, potentially guided by existing rules, or they modify them or create new rules as they take action. For instance, in the context of innovation in the urban bus sector, state government officials may opt against engaging private operators due to their attitudes towards privatization in bus operations (existing cognitive rules). Secondly, trade-offs may be resolved indirectly as a result of the chain of events set in motion by regime actors, even if not explicitly intended. For example, inadequate funding for expanding bus services guided by cognitive rules can over time lead to deteriorating service quality and in turn modal shift towards 2Ws, thus weakening the position of bus systems within the urban mobility system. Finally, trade-offs can also be resolved passively, whereby the socio-material dynamics of the system organically generate rules that favour certain interests. For example, oligopolistic market control by a select number of bus manufacturers can create cognitive rules regarding

understandings of who can and cannot manufacture buses, thereby favouring profitability-related interests of manufacturers over efficiency-related interests of public bus operators.

In each scenario, the focus on rules does not imply a structuralist view of politics. In the first two cases, agency plays a pivotal role, allowing actors to select from various rules to justify their actions or create new ones in the process of making trade-offs, while in the third case, rules would still be reproduced through the actions of regime actors. This perspective aligns with the MLP's conceptualization of structure and agency, drawing from Giddens' notion of the "duality of structure" (1984), where regime rules are viewed as both a means and an outcome of action (Geels, 2011, Geels, 2004).

2.5.2 Construction of landscape pressures

Within the MLP, the landscape has been considered to be the most undertheorized of the three analytical levels (Kivimaa and Sivonen, 2024) and as a residual category that accounts for a wide range of contextual influences (Geels, 2011). This study aims to help operationalize the concept with a focus on how landscape pressures are constructed. Within the MLP, agency plays a central role in bringing a transition (Geels, 2011), with actors crucially making the linkages between the three analytical levels of a sociotechnical system – niche, regime, and the landscape (Geels, 2005b). Here, the role of agency in linking the landscape with ongoing tensions within a regime and the construction of landscape pressures has received less attention than the role of agency in examining niche-regime dynamics (Antadze and McGowan, 2017, Kivimaa and Sivonen, 2024).

The concept of agency at the landscape level was not adequately explored in the early years of growth of transition literature. Fischer and Newig (2016) conducted a systematic review of agency in transition literature up to September 2014, concluding that defining landscape actors and their roles was challenging. One of the early studies focusing on landscape by Morone et al. (2016) identified two types of landscape pressures: unintentional, such as unpredictable events

like war disrupting supply chains, and intentional, where actors deliberately seek to disrupt the existing regime. They conceptualized landscape actors as external stakeholders employing various strategies to influence regimes. While this conceptual expansion brings agency within the landscape, the suggestion of landscape actors being external to regimes is similar to the early MLP literature's segregation of niche and regime actors (Berggren et al., 2015). Antadze and McGowan (2017) argue that niche actors can interpret landscape developments to drive transitions, identifying them as 'moral entrepreneurs' challenging normative rules that sustain unsustainable regimes. These actors aim to dismantle existing regimes by questioning norms rooted in moral foundations, paving the way for new regimes with revised moral frameworks. Kivimaa and Sivonen (2024) further stress the role of interpreting landscape developments, asserting that landscape pressures are socially constructed by actors. They apply this framework to examine how geopolitical developments, such as Russia's influence as a global energy superpower, are perceived differently in Estonia, Finland, and Norway, thereby creating distinct landscape pressures for decarbonizing their energy systems.

I build on this literature to argue that in the absence of actors external to the regime who can interpret landscape developments and construct landscape pressures, this role can also be performed by regime actors themselves. While the regime rule structure may not lend legitimacy to their actions, they can use entrepreneurial strategies and take advantage of windows of opportunity opened by a combination of policy and political developments and problems within the existing regime. Here, it is useful to review the concepts of multiple-streams-framework and policy entrepreneurship that I employ to build this argument.

2.6 Policy entrepreneurship and the multiple-streams-framework

The role of policy entrepreneurship has been an emerging area of study in transitions literature (e.g. Benvenutti et al., 2023), including within the domain of electric mobility transitions (e.g., Lemphers et al., 2022). It has evolved through the interaction of transitions theory with the

policy studies literature, specifically the multiple streams framework (MSF) forwarded by Kingdon (1984) as one of the major theories of policy change, and in particular the agenda-setting process within such change (Reardon, 2018). The MSF suggests that the establishment of the policy agenda and subsequent policy changes occur through the alignment of developments in three distinct streams: the problem stream, where issues and challenges are identified and emphasized as needing attention with potential solutions in mind; the policy stream, where various stakeholders propose and discuss solutions to the problems highlighted in the first stream; and the political stream, which encompasses broader factors such as elections or shifts in public sentiment.

Kingdon identifies policy entrepreneurs as agents of change who are able to identify and make use of windows of opportunity to enable the coupling of the three streams and are able to successfully get their solution pushed through the policy process. While originating in the US, the MSF and policy entrepreneurship theory have been applied in a wide range of geographies. , including developing countries (see Bakir and Gunduz, 2020, Frisch Aviram et al., 2020a for reviews of literature on policy entrepreneurship in developing countries). Indeed, while the MSF's applicability to Indian contexts because of its western origin is worth questioning, my contention is that, given weaker institutional capacity and governance systems often endemic of emerging economies like India (Dutt, 2022b), policy entrepreneurship and the MSF may be well-suited to explain cases of policymaking where certain actors had a prominent role in bringing a new item to the policy agenda. For instance, applying this concept in the Indian context, Goyal (2022) demonstrate the role of a consortium of three institutions, Administrative Staff College of India (ASCI), the Indian Institute of Information Technology (IIIT) Hyderabad, and the Natural Resources Defense Council (NRDC), which played the role of a policy entrepreneur in the adoption of the Energy Conservation Building Code in the state of Andhra Pradesh.

This logic also explains my reasons for using the MSF and policy entrepreneurship from among the wide range of other theories that help explain different stages of policymaking (such as punctuated equilibrium theory, advocacy coalition framework, or policy diffusion). For example, electric mobility did not come on to the policy agenda in India as a result of a crisis or external shock (punctuated equilibrium), or through competing coalitions lobbying for their own policy solutions (advocacy coalition framework), or as a result of influence of policies enacted in other geographies (policy diffusion) (see Nowlin, 2011, Petridou, 2014 for a review of different theories on policy making). In order to explain the actions of a select group of actors who, under no external pressure to act, emphatically and creatively used their resources to create certain policies, policy entrepreneurship and the MSF seem particularly appropriate.

Finally, while the limited applicability of the MSF to the later stages of the policy process beyond agenda-setting has been highlighted and expansions thereof proposed (e.g., Howlett et al., 2015), this criticism is not particularly relevant for the purposes of my research. The early years of national policies on which I focus comprise a mission declaration, a mission plan document demonstrating the pathway to attain the mission targets, and subsequently the launch of a scheme based on the plan document. To that extent, these three serve the purpose of putting electric mobility firmly onto the policy agenda of the Government after which multiple policies, schemes and strategies were enacted that have been driving the transition. Moreover, I should stress here that policy entrepreneurs need not be necessarily policymakers or government actors but can also belong to the private or non-profit sector (Arnold, 2021). However, for my study I focus on policymakers and government actors largely because they were the key policy entrepreneurs in the empirical context I have studied.

The defining characteristic of policy entrepreneurs is their commitment to a policy solution for disrupting the policy status-quo and willingness to invest their resources – time, energy, reputation and even money – in the hope of a future return. Mintrom and Norman (2009) have

suggested four elements that are central to policy entrepreneurship, though not all may be needed or displayed in equal measure in all cases: (a) displaying social acuity; (b) defining problems; (c) building teams; and (d) leading by example. Policymakers use a wide range of strategies to achieve their aims, including forging partnerships and coalitions, strategic use of symbols and imagery to galvanize support, use of media, stimulating potential beneficiaries of the policy and creating political buy-in (see Frisch Aviram et al., 2020b for a review of strategies used by policy entrepreneurs).

Within the MLP tradition, policy entrepreneurship and the multiple-streams-framework have been used as a complementary lens to understand the dynamics of policy-driven transition, where it has been argued the MLP itself is not adequate to understand the full picture (e.g., Benvenutti et al., 2023, Derwort et al., 2022). While the first research question broadly seeks to further examine the role of policy entrepreneurship in transition dynamics, more specifically, I draw upon the concepts of MSF and policy entrepreneurship to examine a particular context within the MLP framework, one where regime actors use entrepreneurial strategies and take advantage of windows of opportunity to interpret landscape developments and construct landscape pressures for transition in the absence of actors external to the regime to perform that task.

The matter of motivation of policy entrepreneurs, i.e., why they invest their time and energy in pushing certain pet projects or solutions, has traditionally been an understudied area (Mintrom and Norman, 2009). While some empirical studies touch upon the motives, studies reviewing the policy entrepreneurship and MSF literature somehow tend not to consider it as a significant theme (e.g., Arnold, 2021). In the few studies where motives have been the subject of focus, the dominant perspective is behavioural, looking at the personality traits and value systems of the actors (e.g., Sanz Sanz et al., 2022). Less attention has been paid to the ways in which the motives of policy entrepreneurs, often elite actors in a position of power, can be shaped by the

politics and political economy of the transition with which they are engaged. I visit this theme in Section 4.4.2.

2.7 Sociotechnical imaginaries

Visions and imaginations of technological futures are an integral part of sociotechnical transitions (Sovacool and Brossmann, 2013, Sovacool et al., 2020a). Technological visions are strategically deployed to guide the development of a niche, as elaborated in the traditions of Strategic Niche Management and Transition Management (Loorbach et al., 2008, Schot and Geels, 2008). Early work on the sociology of expectations identified the role of collective visions in providing transition actors with ideas of attainable technological futures and the means to achieve them (Berkhout, 2006, Borup et al., 2006). Importantly, the visions were identified to have a normative element to it. The technological future needs to be morally acceptable for a wide consensus of actors to believe in it.

A later concept introduced by Sheila Jasanoff and Sang-Hyun Kim (2009), sociotechnical imaginaries, brought the normative element of visions of socio-technical futures to the centre, by linking the role of technology with attaining desired social futures. Their work builds on the concept of social imaginaries, the underlying sense of common understanding that enables society to undertake the collective practices that make up social life (Anderson, 1991, Taylor, 2004). Engagement with social imaginaries has been argued to be necessary towards addressing climate change as these imaginaries help societies prioritize values that are aligned with sustainability, shape their ability to undertake collective action to mitigate climate change, question dominant narratives of social life, and reimagine alternative futures (Stoddard et al., 2021).

For my research, however, sociotechnical imaginaries appear to be more useful as the concept helps to foreground the role of science and technology in shaping the future based on collectively held ideas of desired futures (Jasanoff, 2015). Furthermore, while the literatures on

sociotechnical imaginaries (STIs) and the sociology of expectations (SoEs) overlap in the sense that both emphasize the role of visions of desired futures, I use the former because STIs offer a wider lens to understand how technology is embedded within and shaped by society, culture, and politics. Besides, it helps me speak to a larger, contemporaneous and rapidly expanding body of work within the sociotechnical transitions literature (Rudek, 2022).

Jasanoff defines sociotechnical imaginaries as "collectively held, institutionally stabilized, and publicly performed vision of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (2015: pp. 4). In other words, they are normative visions that are laden with ideas of what the future should be, and not just what is attainable. They are collective and hence held diffusely within society. They are publicly performed across mediums, including print media to gain legitimacy within the collective consciousness and outdo contesting imaginaries. Most importantly, they are visions about sociotechnical futures that are at once shaped by ideas of a desired social order and at the same time help to create that desired social order. They may originate from individuals or small groups and gain legitimacy through the use of power or the formation of coalitions. Multiple imaginaries can coexist, either in tension with one another or in a productive dialectical relationship, where some may be elevated to dominance by powerful institutions such as governments, the media, or the judiciary (Jasanoff, 2015).

Sociotechnical imaginaries have been increasingly deployed in recent years to illuminate issues of transition politics. For example, in their study on competing sociotechnical imaginaries of biogas use and electric vehicles (EVs) in Sweden, Mutter and Rohracher (2022) observe that the biogas imaginary is relatively fragmented, geographically constrained due to its integration with local socio-material resource systems, and linked to notions of limited mobility. In contrast, the EV imaginary is largely unified, widely accepted, and associated with unrestricted growth in

transportation demand. Under these conditions, they argue that electrification imaginaries are likely to dominate visions of possible and desirable mobility futures.

Valdez et al. (2019) investigate two contrasting sociotechnical imaginaries of EVs associated with commercial fleet owners in Milton Keynes, UK. One is where EVs are one-on-one replacements for ICE vehicles without any change in mobility patterns, associated with a user imaginary of EV adopters being rational optimizing decision makers. Another is where EVs are conceived as a way to reimagine existing mobility services and patterns and find new configurations that work, which was associated with a user imaginary of EV adopters being a part of the innovation process. They conclude that a strategy of financial incentives and infrastructure creation was not enough to drive high uptake of EV in the case of organizations driven by the first imaginary of one-on-one replacement. Furthermore, while there was no significant governmental support for the second imaginary, many pioneering business adopters of EVs were able to demonstrate that EVs could be used in innovative and feasible commercial applications. In a different context, Martin (2021) advocates for greater attention to how emphasizing certain sociotechnical imaginaries might limit the adoption of autonomous vehicles (AVs) in ways that support a more sustainable future, such as shared autonomous mobility, while instead enabling AV futures that merely replicate existing car-based systems.

For my research, I use the concept of sociotechnical imaginary as a lens to understand how the politics of passenger mobility systems in India is being enacted through the print news media discourse on electrification. The underlying argument is that visions of desired future social order, reflected in the ways a society collectively imagines its present and future mobility to be organized, can shape discursive preferences for electrification of different modes.

2.8 Synthesis

My research aims to bring together the diverse literatures and theories I have discussed in previous sections in order to understand transitions in an emerging economy like India. For my

first research question, I situate my research in the sub-strands of MLP literature that seek to expand on the classic bottom up MLP framework by examining a significant ongoing sociotechnical transition in an emerging economy. I demonstrate how regime actors can act as policy entrepreneurs and use windows of opportunity to link tensions in the regime to landscape developments and discursively construct landscape pressures to trigger transitions. For the other two research questions, I locate my work in the literature on transition politics. However, I focus on how system change intersects with the inherent politics of sociotechnical systems, rather than examining the politics of system change itself, which resonates more with my first research question. Thus, I examine the enactment of the politics of passenger mobility through the discourse on electrification using the lens of sociotechnical imaginaries and investigate changes in regime rules to understand the changing politics of urban bus regimes as a result of electrification.

My study demonstrates that examining the politics of low-carbon transitions in emerging economies like India can warrant drawing upon a wider set of concepts and literatures, such as policy entrepreneurship, than may not commonly be found within mainstream transitions scholarship. My study also seeks to underline the powerful nature of imaginaries in transitions which can act as a bridge between the politics of the present and the politics of the future. I draw out this point in Chapter 5 where I show how imaginaries tied to particular forms of desired mobility future can create preferences for electrification pathways in the present. Finally, in Chapter 6, I help develop connections between regime rules with the politics of transitions. I show that regime rules do not just account for the stability of an ST regime but can also help explain the process by which trade-offs inherent to the ST system are resolved, and how, during the process of regime change, the re-alignment of rules can also account for changes in the process of resolving the trade-offs.

CHAPTER THREE: METHODOLOGY

3.1 Approach to the study and its evolution through COVID-19

This chapter seeks to explain the rationale behind the overall approach to the thesis, choices made in respect of data sources and analytical methods, and how it all evolved particularly in the context of COVID-19 impacts on my DPhil research plan.

During the initial stages and pre-COVID, the research plan focused on understanding the politics behind the push for electric mobility in India, the trade-offs involved in the push, and the manner in which the trade-offs were being made. Originally, the research plan intended a multi-scalar investigation, with examination of the push for electric mobility envisaged both at the national level and at a state level, using the city-state of Delhi as a case study. This was important given the concurrent nature of urban transportation within the Indian governance structure, where the centre, state and municipal administrations have powers and responsibilities over different aspects of urban transportation. Furthermore, the research plan was completely dependent on field work. Investigating the reasons behind and the process involved in the creation of policies for electric mobility, whether at the national or state level, entailed conducting interviews with key officials engaged in the policymaking process and accessing potential secondary data that may otherwise not be available in the public domain (e.g., minutes of committee meetings, inter-ministerial memos, etc.). Cultural norms surrounding access to government officials in India and the seniority of officials to be interviewed (many potential interviewees were retired officials) made online interviews not a feasible option. Coupled with the nature of secondary data, field work remained critical for collecting the data required for conducting and completing my DPhil research.

The onset of COVID-19, however, caused a 13-months delay to the field work. Around the time of my Transfer-of-Status[3] examination in March 2020 when the UK went into its first lockdown, the plan was still to leave for field work in August 2020 as originally scheduled. However, by May 2020 once it was clear that COVID was not a short-term problem, the departure date was initially pushed back to October 2020. The late onset of COVID in India in comparison to UK meant that by September 2020, even though the UK's situation had improved, India was in the middle of its first wave, and therefore the field work departure date was further moved to January 2021. The situation in UK became worse again in the months of November and December 2020 which further pushed back the departure date to March 2021. Finally, while the situation started to improve in UK by March 2021, by then India came in the grips of its terrible second wave triggered by the Delta variant of the coronavirus. The prolonged second wave and its severity in India, coupled with the possibility of getting fully vaccinated in UK before embarking on field work, pushed the field work departure date finally to September 2021.

Further, I note here that these delays were not just about the sheer feasibility of travel or conducting field work in India and the associated issues of obtaining risk clearance from my Department and the Social Science Division of the University of Oxford (India was on UK's Red list until August 2021), but also the ethical concerns surrounding the recruitment of participants for interviews. The ethical concerns related both to the potential risks of spreading COVID-19 to interviewees through an in-person interview, as well as requesting interviewees to expend their time and mental energy at a time when the country was collectively grieving and grappling with the aftermath of various waves of COVID-19.

Thus, the onset of COVID-19 led to multiple changes and adaptations of the research project, some initially and others later on. The first change was a decision to examine the print news

[3] Transfer of Status exam is an internal assessment conducted by the Department after the end of the first two terms (roughly 6 months) of the DPhil program. Its purpose is to ensure that a DPhil student is making satisfactory progress in the development of the research, that the work is of potential DPhil quality, and that the methodology of the research is appropriate and practicable.

media discourse on electric mobility. Inability to travel to India for field work for an indefinite period triggered a pivot towards a data source that was easily available online, i.e., print news archives on NEXIS-UK database. On one hand, the decision to examine print news media stemmed from the realisation that it would allow me to examine an aspect of the politics surrounding the policy impetus for electric mobility and the trade-offs involved therein that was not originally intended but could be conducted remotely and would yet tie in reasonably well with the original aim of the research. Discourse analysis was in fact intended within the original research plan pre-COVID too, though likely with a different focus and data set (primarily interviews but also reports, tweets, press releases, etc.). Indeed, this decision to pivot to analysis of news media discourse was also in acknowledgement of a growing scholarship on discursive approaches to examining transition dynamics (Isoaho and Karhunmaa, 2019), particularly studies that looked at the news media discourse (e.g., Cerny and Ocelik, 2020, Rosenbloom et al., 2016).

Another change that was made in the research plan involved limiting the investigation to the national-level policies on electric mobility and removing the city-state of Delhi from the focus of the first research question. The original research plan intended to examine the political dynamics behind the creation of policies on electric mobility at the levels of both the central government as well as the government of Delhi. This change was a consequence of experiences during the field work as well as COVID-19 affected delay. After arriving in the field, recruitment of interviewees proved to be a much more difficult task than envisaged. Cultural norms around access to government officials in national ministries changed significantly over the course of COVID-19. For example, pre-COVID, I would have considered it routine practice to walk into national Government ministries and approach the office of senior officials and drop off a request letter for a meeting in person to their private secretary. This was because the chances of securing a meeting with a senior official through a phone call or email to their private secretary was always considered low. An in-person meeting with a private secretary would often give

someone a chance to explain to them the importance or urgency of securing the meeting with the senior official to whom they reported.

However, the onset of COVID-19 closed off the offices to visitors in the first instance. When offices reopened, the embargo on unscheduled visitors continued while cultural norms surrounding granting meeting requests over phone or emails did not change significantly. As a result, it became next to impossible to enter any ministry or arrange a meeting with any official. Coupled with the curtailment of field work from the initial intended period of 10-11 months to 6-8 months due to COVID-19 and the associated delay in travel to India, I decided to limit the focus to the national policies on e-mobility. There was insufficient time to engage with officials of both the national government and the Government of Delhi.

The other reason for limiting the focus to the national-level policies for e-mobility was the emergence of an alternative and interesting theme during the course of interviews, one that could also allow a multi-scalar investigation. This was related to the shifting politics of urban bus systems as a result of electrification. In short, given the lack of time discussed above, and the emergence of this interesting theme, the research plan was revised one more time to allow a focus on the shifting politics of urban bus systems in India as a consequence of electrification.

3.2 Field work

This section discusses the challenges and experiences related to recruitment of interviewees and collection of secondary data during the field work, partly in response to suggestions for scholars to reflect on this important part of the research process (Hopkins and Schwanen, 2022). Through the field work, I intended to collect two types of data, interviews and documents. My target interviewees included senior officials from various ministries in the national government, automobile industry, think tanks and independent consultants who may have been engaged with the process of national-level policymaking on electric mobility between 2010-2015. Similarly, I intended to obtain access to documents that may otherwise not be in the

public domain, such as minutes of intra-and-inter-ministry meetings, intra-and-inter-ministry memos, or internal (unpublished) studies conducted or commissioned by the government related to electric mobility. I expected to collect these documents primarily from the offices of ministries related to electric mobility, as, to the best of my knowledge and understanding, there is no practice of archiving them centrally anywhere. However, through the course of my field work, I had to adjust my expectations related to secondary data collection and adapt my strategies regarding recruitment of interviewees, as detailed in this chapter.

Overall, I conducted about 7 months of field work from September 2021 to April 2022. A follow-up phase of field work was also conducted for about 4 weeks in December 2022 – January 2023 to conduct some additional interviews I believed were necessary, particularly related to the third research question. I conducted a total of 34 interviews across the two phases of field work.

Various ethical issues were considered before going to the field work and accordingly mitigatory steps were proposed in the CUREC (Central University Research Ethics Committee) application (and executed during the field work and later on during the analysis and writing stages). These included:

- Access to interviewees: During the field work, once I realized getting access to interviewees was going to be lot more complicated than I had envisaged, the option of using prior industry connections to potentially ease recruitment created an ethical issue. I could use my connections to try and get access to interviewees, but that would imply using a privilege that other researchers in my position without any prior industry connections would not have. To deal with this dilemma, I spent the first two months trying to do the recruitment on my own until I reached a point when it was clear that I may have to spend many more months in this manner and there would be no guarantee that I will be able to recruit the interviewees I needed. Thus, the constraints of time left to conduct the field work (already complicated due to COVID-19) and the financial

implications of the delays in executing field work made me decide to finally approach my industry connections which proved to be instrumental in gaining access to key interviewees (see later in this section).

- Anonymity of interviewees: The identity of all participants was decided to be kept anonymous, whereby direct links to the identity of the interviewees were removed from the transcription sheet and all research outputs. All interviewees have been assigned a code that reflects a category of their affiliation, such as government, thinktanks, or industry.
- In very limited cases, I withheld certain pieces of relevant information from the analysis and empirical chapters, in part because the interviewee shared the information with the strict understanding that I would not include it in my research outputs. Moreover, in such cases, it was clear that very few people were privy to that information whereby including the information within the research output would itself be tantamount to revealing the identity of the interviewee.
- Similarly, I had stated in my CUREC application that I would not include any information gained during my field work in my research outputs that could potentially compromise national security. However, I did not come across any information during the field work that would need to be withheld for such reason.
- Interview recording and transcripts were to be encrypted before storage in my secure password-protected One Drive account provided by the University. Prior to the start of the interview, all participants were to be explained about their anonymity and the process being followed to ensure that. The interview was to proceed only upon their affirmation and record of consent.
- Confidential or sensitive information: Should participants feel uncomfortable about sharing any particular piece of confidential or sensitive information, the option was to be offered to the participant to share it with the audio recording being turned off.

- Participants may feel unsure about in-person meetings as a fallout of the COVID crisis. In such cases, the interview was to be conducted online.

Furthermore, to reduce the risks from COVID-19 both for myself and my interviewees, I proposed various strategies prior to embarking on the field work as part of the risk-clearance process and later attempted to execute those strategies during the field work. These included steps like conducting online interviews where possible, ensuring social distancing, wearing of masks during in-person interviews, avoiding small or crowded rooms as much as possible, avoiding public transport enroute to in-person interviews, and generally practicing all COVID safety compliant strategies like use of hand sanitizer and reducing unnecessary social contact.

All these steps turned out to be largely irrelevant because most of my interviews, at least during the first leg of the field work when COVID-19 was still prevalent, were conducted online. In the limited instances where I conducted in-person interviews during the first leg, some of the proposed steps turned out to be impractical. For example, I would consider it culturally inappropriate to decline the offer of a cup of tea or coffee in the office of a senior official, even though it would mean lowering or removing the face mask. In such cases, I tried to ensure a reasonable physical distance between myself and the interviewee to the extent possible. Finally, I note here that while in the end most interviews were conducted online, the recruitment of interviewees would not have been possible remotely without physically traveling to India. This is further explained below.

The recruitment of interviewees proved to be a very arduous and time-consuming task. A large number of potential interviewees had retired by the time my study began, some a long time back, with little to no internet presence, including over platforms such as LinkedIn or Twitter. Thus, I used a mix of recruitment strategies, including:

- emailing them on addresses extracted from old reports, internet pages, press releases and tweets

- Messaging via LinkedIn where possible
- Physically visiting offices, where possible, and dropping off request letters for interviews
- Meeting and calling in favours from senior ex-colleagues in the industry and government for being introduced to certain officials

The last strategy proved to be the most effective, particularly in the case of some government officials. This can be largely attributed to, what an interviewee later explained as, a trust deficit, whereby government officials do not easily trust strangers when it comes to interviews or divulging information related to the dynamics of policymaking. I attribute this lack of trust to a wider and growing culture of opacity in governance and politics in India and fears within the bureaucracy of reprehension from their political bosses if they are caught out of line (Patel, 2023). This issue, however, was addressed if the interview request was channelled via a person known to the interviewee. I also observed a snowballing effect, where it became gradually easier to recruit interviewees after the first one as I could take the reference of someone who I had interviewed for approaching the next interviewee. While the strategy of recruitment summarised here was successful for me, it raises questions about the practicalities of researchers without any prior industry or government connections who want to conduct studies like mine in the present political climate of India.

During the process of recruiting some government officials for interviews, I could not help reflecting upon whether the 'Oxford' tag may have proved to be a roadblock in establishing trust with them. There has been a growing political discourse within the Modi Government that questions the credibility and intent of Indian academics at the world's 'leading' universities when it comes to their views on public policy matters in India. Prime Minister Modi had name checked 'Oxford' during a speech in 2017 where he dismissed concerns raised by some very high-profile academics about one of his controversial policy interventions of the demonetization of certain currency notes. One reading of this may be a powerful government in

an emerging economy trying to make the country shake off some of its colonial hangovers, i.e., reverence for opinions of Indian academics at prominent western institutions purely because of their affiliation. However, in reality, this reading offers a guise for the Government to deflect and diminish criticisms about its policies and strategies from some credible and high-profile public figures.

The strategy of sending emails proved moderately effective, particularly in the case of interviewees in the automobile industry, even though in almost all cases multiple follow-ups were required. In certain cases, multiple follow-ups over a course of more than four months still did not yield an interview while a few denied the interview request, citing their organisational policy for speaking to external members. LinkedIn was found to have limited use. The least effective strategy, as discussed earlier, turned out to be direct in-person visits. Post COVID, almost all agencies, government or otherwise, had turned rather opaque in terms of access. In multiple cases, I was advised to first arrange an appointment to access the office reception to drop off a request letter, even after I expressly pointed out that the whole point of accessing the reception was to request an appointment as there was no other alternative way to do so.

The collection of documents proved to be an even more difficult affair than recruitment of interviewees. Access to past minutes of meetings, memos, and files was denied outright by a concerned government official at the Ministry of Heavy Industries. I filed a right-to-information (RTI) application seeking minutes of the meetings of the National Council on Electric Mobility (NCEM) and the National Board on Electric Mobility (NBEM). The NCEM and NBEM were constituted alongside the declaration of the National Mission on Electric Mobility in 2011 and were meant to guide the process of policymaking on electric mobility (Press Information Bureau, 2011). My RTI application was denied under the provisions of Section 8(1)(d) of The Right to Information Act, 2005 that exempts government from having to divulge information on matters that relate to “commercial confidence, trade secrets or intellectual property, the

disclosure of which would harm the competitive position of a third party, unless the competent authority is satisfied that larger public interest warrants the disclosure of such information" (Government of India, 2005: p. 8). I was also unable to access a background report that significantly contributed to the development of the National Electric Mobility Mission Plan 2020 as no copies of the report were available within the government or with any of the interviewees. Notwithstanding these issues, documents and reports that were available in the public domain along with the interviews proved to be sufficient to answer the research questions of the study.

3.3 Data and methods

This section outlines the different methods and data employed to address different research questions with which this study engages. The choice of data and methods was dictated by the research questions and the practicalities of field work discussed earlier. A detailed discussion on the methods and data used in the case of each research question has been provided in Chapters 4 to 6.

3.3.1 Data used in the study

Against the backdrop of the discussion in Section 3.2, this section provides some reflections on the different types of data used to conduct the analysis.

Data from the interviews was used for addressing the first and third research questions. For the first research question (RQ1), the purpose of the interviews was to get insights into how and why the early national policies on electric mobility were created. Thus, a wide list of potential interviewees was cast to include (past and present) officials from various national government ministries, automotive firms and their associations (SIAM and SMEV), thinktanks/ non-profit organizations/ development agencies working on urban mobility and environmental issues – essentially, anyone and everyone who may have been directly engaged in the creation of those policies or have a second-hand knowledge of it. Having worked for over eight years in India, I was aware that the policy making process is influenced primarily by actors from the industry,

non-profits, development agencies, and consulting firms, aside, of course, from the government officials themselves. I aimed to cover all of these other than consulting, at least in the first instance. This is because it is not possible to directly know which specific consulting firm may have been involved in any policy-making process. Furthermore, again from my experience of having worked in a consulting firm myself on national policy-making matters, I was aware that consulting officials, if at all identifiable, were very unlikely to agree to interviews unless I explicitly came with instructions or permission from their client, the government. A template of an interview questionnaire covering some of the main themes is provided in Annexure 1.

An anonymized list of interviewees has been provided in Chapter 4 with each interviewee assigned a code bearing a category of affiliation, such as government, auto industry, and thinktanks. The exact affiliation of any particular interviewee is being withheld as it can easily lead to their identification, since a very small number of people within those organizations are likely to have knowledge on the inner dynamics of national policy making. Interviewees were asked questions related to the following topics (not exhaustive):

- Major factors that prompted the creation of policy frameworks for EVs in India around the turn of the last decade (2009-2011), namely the NMEM and NEMMP 2020?
    - How important was the Indian automotive sector's ambitions (nascent, but growing around the time) for EVs in this regard? Was there any link to China's growing EV ambitions?
    - Did India's energy security ambitions play a role in the formulation of these policies? How so?
    - How important were air pollution and climate change as contributing factors?
    - Did other international factors play a role, such as the IEA's (International Energy Agency) Clean Energy Ministerial/ Electric Vehicles Initiative?

- What happened between the formulation of NMEM, NEMMP and the FAME Phase I scheme? Was NMEM → NEMMP → FAME I always the plan? What factors led to the launch of FAME I?
    - Did Indian automotive play any role in the formulation of shaping of the scheme and its priorities?
    - Did India achieving power surplus in 2015 have any role, or in general India's energy security ambitions and power sector have any role in this?
    - Did the Paris Agreement play any role in this, or in general India's climate commitments?
    - Did other international factors play a role, such as the IEA's Clean Energy Ministerial/ Electric Vehicles Initiative, or China's growing EV ambitions?
    - Did local issues like air pollution affect the creation of the scheme?
- Evolution of FAME I scheme from 2015 onwards, in terms of extensions, changes, the roll out of Phase II - what played a role in it?
- Future of EVs in India
- Political economic factors that could play a role in the future of EVs in India and how that may unfold

The interviewees were forthcoming to different degrees in the interviews in terms of responses to my questions, or about information that I had not directly asked for. One particular theme I found was interviewees who themselves had a PhD were lot more sympathetic towards me and were more forthcoming and generous in terms of providing answers. I did not have any instance of any interviewee declining to answer a direct question, although in the case of some OEMs, interviewees would sometimes choose to not respond directly to the question I asked, in which case I would not press further. I was also not able to directly frame questions to corroborate information that a previous interviewee may have provided as that would immediately lead to the interviewee asking me the source of my information. In such cases, I would choose to frame

the question more generally with the hope that they may themselves choose to elaborate the information I was looking for, which sometimes worked.

While I was not able to secure all the interviews I would have liked to conduct for RQ1, I am confident that I conducted enough to address the question. For instance, I was not able to secure an interview with any representative of the SMEV despite my repeated attempts. SMEV was established in 2008 and it is likely that they could have provided some interesting insights into the policymaking process on electric mobility that started around the time of their incorporation. But from all the other interviews I conducted, it did not appear as if SMEV had a significant role or influence in the process at the time. Similarly, I was not able to interview a key person from the Society of Indian Automobile Manufacturers (SIAM) who was closely involved with national policymaking during 2010-2015, as they did not respond to multiple interview requests. However, their role was outlined by multiple interviewees. Thus, while it is possible that the insights from this particular interviewee may have potentially enriched the findings to a degree, it is unlikely it would have provided any insights that might be at variance with the overall findings of the study.

Various types of secondary data were used to complement the findings from the interviews. These included the following:

- The NEMMP 2020 report
- Publicly available online copies of a wide range of policies, schemes and technical reports on electric mobility, climate change, energy security, manufacturing and other policy issues prepared by various arms of the Government of India
- Election manifestos of political parties
- Various press releases by the Government of India, related to national policies between 2010 and 2015

- Annual reports of various automotive firms, news archives and other relevant documents and websites found over the internet.

Furthermore, various types of secondary data were used to substantiate some of the arguments in Chapter Four. These included the following:

- Data on sales of electric vehicles in India extracted from online sources such as the websites of Society of Manufacturers of Electric Vehicles (SMEV), and the International Energy Agency
- Data on year of incorporation of various EV manufacturing companies extracted from the websites of SMEV and Ministry of Corporate Affairs, Government of India
- Data on tweets put out by India's Minister for Road, Transport and Highways on electric mobility, extracted from X's (formerly Twitter) website using its advanced search functionality.

The main findings about the RQ1 relate to 'how' and 'why' the early national policies were created. The 'how' pertains to the process whose different parts were included in the analysis either on the basis that they were corroborated by multiple interviewees or that they were sourced from an interviewee who was centrally involved with that part of the process, and therefore, I had sufficient confidence in the accuracy of their account. The answers to 'why' were largely based on themes that emanated from multiple, if not all, interviews and could also be detected within some of the documents. The interviews were terminated once there was confidence that almost everyone who was closely involved with the policymaking process who was available had been interviewed, and no major questions remained on the process based on the accounts of the interviewees.

In the case of the third research question (RQ3 – discussed ahead of RQ2 here because both RQ1 and RQ3 used interview data but RQ2 did not), the list of potential interviewees included officials from three State Transport Undertakings (STUs), public agencies in charge or urban bus

operations in India (see Chapter 6 for a discussion on the reasons behind the selection of three STUs), officials from other national and state government departments, officials from the non-profit/ thinktank/ consulting/ development sector, officials from automotive firms and their associations (SMEV/ SIAM) and private bus operators. The idea was to interview officials from all types of organizations engaged with the matter of urban bus services in different ways and capacities, who would have insights or opinions on the changing politics of bus systems as a consequence of electrification. The interviewees were asked questions on the following themes (not exhaustive):

- Reasons and mechanisms behind the increased involvement of private sector in urban bus operations with the shift to e-buses
- Changes being triggered due to the shift to PPP (public private partnership) based model of operations & maintenance of buses
- Changing meaning of bus systems for users, politicians, public officials, etc.
- Changes in service levels and delivery mechanism being triggered through a shift to e-buses

Unlike the case of RQ1, most interviewees, possibly with the exception of OEMs, were forthcoming in terms of their responses to my questions. Interviewees from OEMs and private bus operators were less forthcoming on questions related to the changing roles of OEMs within urban bus operations. In my view, this was because they did not want to voice opinions on a matter that on the one hand was tied directly to their business potential, but on the other, a cause of concern because the change was putting the OEMs in unfamiliar territory (see Chapter 6 for a discussion on this).

In the case of RQ3, there was no notion of 'key' or 'crucial' interviewees whose omission might merit a discussion here. Unlike the case of RQ1, RQ3 does not rely on accounts of key persons associated with a process. Rather, it seeks to view the ongoing transition to e-buses through the

eyes of a wide range of stakeholders engaged in various aspects of the transition (e.g., operators, consultants, researchers, manufacturers, policymakers, etc.) while focusing on the shifting politics of urban bus systems. As such, the criteria for stopping the interviews were an element of saturation along with time and money considerations. Towards the end of the second leg of my field work in December 2022-January 2023, during which I conducted additional interviews specifically related to RQ3, I started to feel that there was no substantial addition to the information I was receiving during the interviews. Alongside that, I had significant concerns around the delays to my DPhil submission that could happen if I carried on with the field work beyond January 2023 and the financial implications of doing so[4]. Therefore, I terminated the interviews around the end of January 2023 with a reasonable degree of confidence that I had sufficient information within the interviews I had conducted to be able to build a cogent argument in response to the third research question.

Finally, various types of secondary data were collected and used to complement the findings from the interviews and substantiate other arguments in Chapter 6. These included the following:

- Data on various indicators of physical and financial performance of public bus agencies in Delhi, Mumbai and Bengaluru collected from the agencies during field work
- Archived news articles
- Data on sales of electric vehicles in India extracted from online sources such as the websites of Society of Manufacturers of Electric Vehicles (SMEV), and the International Energy Agency
- Data on year of incorporation of various EV manufacturing companies extracted from the websites of SMEV and Ministry of Corporate Affairs, Government of India

[4] At the time, my DPhil scholarship funding was scheduled to terminate by the end of February 2023. Eventually, I received one final funding extension that supported my living costs till June 2023.

- Various press releases by Government of India regarding electric mobility policies and schemes available online
- Publicly available online copies of a wide range of policies, schemes and technical reports on electric mobility, climate change, energy security, manufacturing and other policy issues prepared by various arms of the Government of India, state governments and public bus agencies of Delhi, Mumbai and Bengaluru
- Election manifestos of political parties available online

The second research question (RQ2) primarily comprises the analysis of print news media articles. The main source of data, therefore, was news archives extracted from the NEXIS UK database from three English Newspapers (The Times of India (TOI), The Indian Express (IE) and The Hindu (Hindu)) with some of the highest circulation figures in India for the period of 2009-2020 (see Chapter 5). A total of 275 articles were sampled from a corpus of articles extracted from these three newspapers using a search criterion that looked for all articles that had any of the following keywords in the headline:

"electric mobility" OR "electric vehicle" OR "electric vehicles" OR "EV" OR "EVs" OR "electric car" OR "electric cars" OR "electric bus" OR "electric buses" OR "electric 3 wheeler" OR "electric 3 wheelers" OR "electric 3-wheeler" OR "electric 3-wheelers" OR "electric rickshaw" OR "electric rickshaws" OR "e-rickshaw" OR "e-rickshaws" OR "E3W" OR "E3Ws" OR "e-bike" OR "e-bikes" OR "electric bike" OR "electric bikes" OR "e-scooter" OR "e-scooters" OR "electric scooter" OR "electric scooters" OR "electric 2 wheeler" OR "electric 2 wheelers" OR "electric 2-wheeler" OR "electric 2-wheelers" OR "E2W" OR "E2Ws"

The time frame for the articles (2009 – 2020) was chosen to, at the lower end, roughly coincide with the time when work started on creating the early national policies on EVs in India, and at the upper end to preclude the distortion in news media reporting that the onset of COVID-19 would have invariably created. Secondly, the choice of English newspapers was borne out of

logic as well as necessity. For the time period in question at least, electric mobility was largely an urban phenomenon, and the readership of English newspapers in India is also largely urban. Regional language newspapers were not chosen as the scale of the analysis was intended to be at the national level. The necessity factor was linked to the lack of availability of archives of Hindi newspapers on the NEXIS UK database.

Thirdly, the three newspapers were selected to reflect some of the most widely circulated English newspapers in India as well as a diversity of perceived political slant of the three newspapers – TOI as centre-right, IE as centre-left with Hindu to the further left of IE[5]. Although, in hindsight, consideration of political slant did not yield any insights during the analysis as I was unable to differentiate the discourse or imaginaries according to the newspapers' political leanings. This might mean that the political slants of the three newspapers, that are not explicit to begin with, may not have a marked influence on the discourse on EVs. Alternately, and this is my contention, one might need an overall bigger sample size to conduct a comparative analysis.

Fourthly, articles were extracted for analysis based on the presence of key words related to EVs (see Chapter 5) in headlines rather than the body of the article. This was primarily with the aim of examining articles where EVs were likely to be primary object of discussion. This also ensured that I was starting with a corpus that was manageable for manually screening out spurious (e.g., articles which may use 'EVs' to refer to something else than electric vehicles) or duplicate articles which do not accurately get filtered out through the "group duplicates" function of the database. I found manual screening a viable task and it also allowed me a first-hand exposure into the overall corpus which may have benefited me intangibly during the analysis stage.[6] Finally, twenty percent of the corpus was selected for analysis as I deemed it as a reasonable

[5] Political slants of news media in India is not an explicitly or openly known matter, hence one has to go by perception (see Chapter 5).

[6] While there are likely to be non-manual ways to conduct this exercise in a more efficient way, such as using AI or natural language processing, I cannot reflect on the pros and cons of using a manual over non-manual method as I am not familiar with the latter methods and thus, I would not be aware of their exact capabilities until I have used them myself.

representation of the corpus and a reasonable number of articles (275) to analyse given the time constraints. Here again, it is not possible for me to reflect on non-manual methods of analysis for the reasons discussed above.

Finally, some other sources of secondary data were used to substantiate other arguments in Chapter 5. These included:

- Data on sales of electric vehicles in India extracted from online sources such as the websites of Society of Manufacturers of Electric Vehicles (SMEV), and the International Energy Agency
- Data on year of incorporation of various EV manufacturing companies extracted from the websites of SMEV and Ministry of Corporate Affairs, Government of India
- Various press releases by Government of India regarding electric mobility policies and schemes available online
- Publicly available online copies of a wide range of policies, schemes and technical reports on electric mobility, climate change, energy security, manufacturing and other policy issues prepared by various arms of the Government of India
- Election manifestos of political parties available online

3.3.2 Analytical methods

The analytical approach to the study is by and large qualitative and interpretative. The overall study, notwithstanding the changes and adaptations in the research plan, remains loosely informed by a critical realist ontology. Critical realism recognizes the existence of reality beyond what is empirically observable and stresses the importance of structures and mechanisms in influencing social phenomena and events (Fletcher, 2017). Structures here could include institutions, cultural norms, power dynamics, or other underlying frameworks that shape social interactions and phenomena. Mechanisms imply the processes through which these structures

operate or influence social phenomena, such as cultural and social practices, discourse, acts of imagination, and so on.

Such an ontology suits investigation of causality in sociotechnical transitions, given its focus on actors, events, causal mechanisms and structures (Geels, 2022). This fits neatly with the first research question focusing on the reasons and processes behind the creation of the early national policies on electric mobility. Here, the use of a process tracing as a method suits the research purpose well. Process tracing, originating from political science, is employed to conduct in-depth within-case empirical analysis of how causes are linked to outcomes through causal mechanisms or processes (George and Bennett, 2010). Deconstructing these mechanisms entails breaking down the process into sets of entities engaged in activities that form a productive relationship. In this relationship, the activity of one entity triggers or influences subsequent entities, creating a chain of events (Beach and Pedersen, 2019). To do this, one must gather 'mechanistic evidence' within the case, i.e., traces left by the activities of entities associated with the mechanisms. This evidence can be empirically discovered through various means, such as the analysis of meeting minutes (Bennett and Checkel, 2015).

Process tracing can be useful to dig deeper into the issue of causality which can often be blackboxed within transition studies. In particular, within policy-driven transition contexts, process tracing can help to bring out the dynamics between actors, structures, and events that can trigger or drive transitions. It is for this reason that process tracing has been increasingly used in transition studies in recent years (e.g., Corral-Montoya et al., 2022, Lelieveldt and Schram, 2023, Lockwood et al., 2019). Within the Indian context, Haldar et al. (2024) have employed process tracing to analyse the creation of a large-scale solar energy park in Pavagada, Karnataka. They undertake a similar approach in terms of relying on documents and in-depth interviews with key actors to map the various activities that led to the creation of the solar park. A key distinction between their approach and mine, however, is that they were able to construct

a wireframe and timeline of events based on available documents and thereafter rely on interviews to focus on the activities involved at each step by various actors. For my research, given the sensitivity around the creation of the policies I was investigating, I had to rely on a mix of interviews as well as documents to trace the process of policy development. It reflects that, depending on the nature and sensitivity of the policy or development, and potentially the scale (national/ state), the available approach to conduct process tracing in India may vary and researchers may have to adapt their strategy as well as expectations in terms of the depth to which a process can be traced.

For the second research question, an analytical approach informed by Critical Discourse Principles (CDA) was adopted. CDA is a combination of critique of discourse and explanation of how it figures within and contributes to the existing social reality (Fairclough, 1989). As mentioned earlier, discourse, here understood as a particular way of thinking and talking about an issue (Geels and Verhees, 2011), is one of the mechanisms that helps shape social reality by influencing how people understand and interpret the world around them, thus making CDA, or at least Fairclough's version of it with which I largely engage for the current study, broadly compatible with critical realism (Banta, 2013, Fairclough, 2005). The CDA of a news article involves the analysis of relationships between three dimensions of the news article – the text itself, the processes of production and consumption of that text (discourse practice) and the socio-cultural context of the text (sociocultural practice) (Fairclough, 1995). For investigating the imaginaries being constructed within the discourse, the study focuses on the analysis of the text and its socio-cultural context. It seeks to go beyond the surface level of language to examine the deeper social, economic, and political structures (such as class politics) that influence and are reflected in the discourse. This study does not delve into the processes of consumption and production of the news text, which could offer insights into how the imaginaries take root within the social consciousness, and the mediating role that news media plays in that process. However, that is beyond the scope of this study.

In the case of the third research question (RQ3), the focus on regime rules resonates directly with the critical realist view of the role of structures in influencing social phenomena. For this RQ, thematic analysis (Braun and Clarke, 2006, 2022) has been used as the analytical method. Thematic analysis is a qualitative research method used to identify, analyse, and report patterns or themes within data and is largely agnostic to theoretical framing and ontological assumptions. This method was useful to detect evidence of changing rules of the urban bus regime based on data from interviews and secondary sources like news articles and official press releases of the government. Changing cognitive and normative rules (such as attitudes and value systems) can only be detected on the basis of a pattern, rather than a single case, of evidence. For this RQ, I have employed one of the three main schools of thematic analysis, called coding reliability (Braun and Clarke, 2022). In this approach, a codebook or coding frame is created, and data is allocated to predetermined themes. In this case, I used this approach to map evidence of changing rules from within the interview data.

3.4 Synthesis

For this thesis, diverse methods have been employed to answer the three research questions. The methods together help to understand the overarching theme of this thesis, i.e., how the process of resolving tradeoffs between competing interests associated with passenger transportation manifests and changes as the system transitions to electric mobility. This process of resolution occurs in different ways, within the dynamics of policymaking, through the legitimation of choices via various types of discourse including news media discourse, and at a structural level in terms of cognitive, regulative, and normative rules associated with the process of resolving the tradeoffs. By employing different methods, I am able to bring to light this diversity of the dynamics by which the politics of transition to electric mobility plays out.

Moreover, the different methods help to highlight that they can be used to develop a deeper understanding of these dynamics at different levels or within various domains, though that was

not possible within the scope of this study. For instance, while my thesis examines the process behind the creation of early national policies on electric mobility, media discourse analysis of transportation policy between 2008 and 2015 may show how the resolution of various tradeoffs associated with transportation policymaking was legitimised or delegitimised within news media to justify the national policy foray in the EVs. Similarly, an examination of regime rules associated with the resolution of tradeoffs within transportation policymaking could offer structural insights into the shifting politics of transportation policymaking around the period of creation of early national policies on electric mobility. Further, while my thesis looks at how priorities for electrification of different modes were legitimised in the news discourse, process tracing could help understand how these priorities have evolved within national policymaking, albeit over a longer time frame such as between 2010 and 2022. One could also examine the changes in rules associated with prioritising different modes within transportation policymaking that may have happened along with the transition to electric mobility. Finally, while my thesis examines the shifting politics of bus systems through the examination of regime rules, media discourse analysis could help understand how the shifting politics are being legitimised. Here again, a process tracing approach could help reveal the dynamics of policymaking associated with the changes in the process of resolving tradeoffs, such as through an emphasis on public-private-partnership models of bus operation. While these were not within the scope of my thesis, by employing different methods, I am able to shine light on the different dimensions of the politics that manifests with the transition and offer directions for future research to develop a deeper understanding of this matter.

CHAPTER FOUR: "*WE DID NOT WANT TO MISS THE BUS ON THIS ONE*" - POLICY ENTREPRENEURS AND THE TRANSITION TO ELECTRIC MOBILITY IN INDIA

Abstract

Electrification has emerged as the key strategy for decarbonization of road-based transportation in India. This paper investigates how, and why the initial set of national policies on electric vehicles (EVs) to trigger and drive the transition were created between 2010 and 2015. It finds that the polices were created through the discursive construction of landscape pressures, by regime actors who displayed policy entrepreneurship traits and connected landscape developments related to concerns around growth in manufacturing with the tensions within the fossil-fuel vehicles regime regarding its inability to help India become a global leader in manufacturing. The study helps address the under-theorisation of landscape pressures within the transitions literature and helps bring the multi-level-perspective framework and the multiple-streams-framework into a meaningful conversation with each other.

Keywords: ***electric mobility, sociotechnical transitions, landscape, policy entrepreneurship, India***

4.1 Introduction

CO_2 emissions from India grew at a rate almost five times that of the world between 2005 and 2019 (IEA, 2022). Transportation recorded the highest growth rate (168%) within major emitting sectors during this period, and accounted for over 13% of India's energy-related CO_2 emissions in 2019 (ibid.). A staggering increase in motorization (230% increase in total registered vehicles in 2005-2019, see Government of India, 2021) is responsible for this growth in emissions. With the need for decarbonization looming large, electric mobility has emerged as a key policy strategy (see Government of India, 2015). Electrification in India has been largely driven by national policies starting with the creation of a National Mission for Electric Mobility in 2011, the first stated policy intent in respect of electric vehicles (EVs). Furthermore, to complement national policies, many State governments have come up with their own policies and schemes in recent years. Such increased policy attention notwithstanding, the diffusion of electric mobility in India still remains around or less than 5% across all modes other than 3Ws (Clean Mobility Shift, 2024). The challenges the EV transition faces in India makes it a pertinent case for transition scholarship to study.

A large strand of extant literature takes a techno-economic view of this transition and provides insights on the acceleration of electrification and quantifying its impacts on environment (e.g., Digalwar et al., 2022, Hossain et al., 2023, Rajagopal, 2023, Veerendra et al., 2022). Moving away from this, this paper seeks to understand the dynamics of the early years of the transition, i.e., how and why some of the early national policies were created to trigger and drive the transition from internal combustion engine vehicles (ICEVs) to EVs. Thus, this paper speaks to the broader literature on regime change including the classic niche-driven bottom-up transition (Geels, 2012) but particularly recent scholarship that diverges from this framework and shows how transitions can happen without a niche (Ghosh and Schot, 2019), be top-down (Trencher et al., 2021), driven by incumbent regime actors (Tan et al., 2021) or by actors that are difficult to

categorize within the binary definitions of niche or regime (Dutt, 2022b). In particular, it focuses on the role of regime actors in establishing linkages between the landscape and internal tensions within the regime to construct landscape pressures for triggering a transition, an aspect that has not received adequate attention in transition literature. The paper also contributes to emerging transitions scholarship on electric mobility in India. Dutt (2023), for instance, has examined the evolution of the electric 2W niche in India, where he discusses the significance of landscape pressures such as rising fuel prices and growth of an entrepreneurial ecosystem and developments in battery technology as notable contributing factors. In particular, he notes the strong influence of national policy in helping the niche develop and grow. This paper factors this analysis and explains the dynamics that created the policies in the first place during the early years of the transition. In doing so, it helps to fill what is an important gap in scholarly understanding of India's ongoing transition to electric mobility, i.e., the dynamics of the early years of transition.

The next section reviews different literatures and concepts that this study situates itself in and engages with respectively while Section 4.3 explains the methodology and data used for the study. Section 4.4 provides an overview of the transition and its linkages with early national policies and schemes while Section 4.5 discusses the role of policy entrepreneurship in the creation of the policies. Section 4.6 offers some conclusions from this study and its implications.

4.2 Literature review

The multi-level-perspective (MLP) has been a popular approach for examining sociotechnical transitions (Sovacool et al., 2020b). Within the classic formulation of MLP, a transition occurs when niche innovations are able to make use of opportunities created by destabilization in a regime caused by internal tensions and pressure from the landscape to challenge, disrupt and eventually change the regime (Geels, 2005b). Importantly, the transition is 'shot through' with

agency (Geels, 2011), with actors crucially making the linkages between the three analytical levels of a sociotechnical system – niche, regime, and the landscape (Geels, 2005b). Here, the role of agency in linking the landscape with ongoing tensions within a regime has received less attention than the role of agency in examining niche-regime dynamics (Antadze and McGowan, 2017, Kivimaa and Sivonen, 2024).

During the early years of the development of transition literature, the landscape was considered to have no room for agency, with a systematic review of agency in transitions literature published up till September 2014 concluding it was difficult to define a landscape actor or their function (Fischer and Newig, 2016). Morone et al. (2016) identified two sources of landscape pressures, unintentional and intentional, with the former comprising unpredictable activities that may incidentally affect the regime (such as a war disrupting an established supply chain) and the latter comprising concerted activities by actors to induce a misalignment of the landscape with the regime. They conceptualized landscape actors as various stakeholders external to the regime that use various strategies to apply pressure on the regime.

While this remains a valuable conceptual expansion in terms of linking agency to the landscape, the presumption of landscape actors being external to regime seems to posit a similar conceptual segregation between actors at the niche or regime vis-à-vis landscape levels as early MLP literature implied between niche and regime actors (Berggren et al., 2015). Indeed Antadze and McGowan (2017) suggest that that niche actors can interpret landscape developments to drive transitions. They identify these actors as 'moral entrepreneurs' who aim to challenge normative rules at the landscape level that sustain current unsustainable regimes. By questioning these norms rooted in moral foundations, these entrepreneurs aim to dismantle existing regimes and create pathways for new regimes with revised moral frameworks. This idea of interpreting landscape developments has been emphasized by Kivimaa and Sivonen (2024)

who argue that landscape pressures are socially constructed by actors which explains varying responses of different jurisdictions to landscape pressures of climate change or cyber security.

I take on board the position that different actors play different roles within a transition at different times depending on the transition configuration. In other words, niche, regime, and landscape actors are not static identities, but roles played by different actors. In the absence of actors external to the regime who can interpret landscape developments and socially construct the landscape pressures, I argue that this role can also be performed by regime actors themselves. While the alignment of existing normative, regulative and cognitive rules of the regime may not lend legitimacy to their actions, they can use entrepreneurial strategies and take advantage of windows of opportunity opened by a combination of policy and political developments and problems within the existing regime. Here, it is useful to review the concepts of multiple-streams-framework and policy entrepreneurship that speak to this argument.

The role of policy entrepreneurship in transitions has become an emerging area of study (Friedman and Rosen, 2022, Mintrom and Rogers, 2022), including within the domain of electric mobility transitions (e.g., Lemphers et al., 2022, Wikström et al., 2016). This area of study has evolved through the interaction of transitions theory with the policy studies literature, in particular the multiple-streams-framework (MSF) originally forwarded by Kingdon (1984) as a theory for policy change, in particular the agenda-setting process (Reardon, 2018). The thinking on multiple streams and policy entrepreneurship can be integrated into the MLP to understand the role of policy-driven transitions (e.g., Benvenutti et al., 2023, Derwort et al., 2022, Arslangulov and Ackrill, 2024). This study develops this idea to deepen the understanding of the role that regime actors play in constructing landscape pressures.

The MSF posits that the setting up of policy agendas and subsequently policy changes happen as a coupling of developments in three independent streams: the problem stream, where issues and problems get articulated and highlighted as something that requires addressing and for

which solutions may be available; the policy stream, where various stakeholders propose and debate their solutions to the problem articulated in the first stream; and the political stream, consisting of various developments such as elections or changes in the national mood.

Policy entrepreneurs are agents of change who are able to identify and make use of windows of opportunity to enable the coupling of the three streams and successfully get their solution pushed through the policy process. The defining characteristic of policy entrepreneurs is their commitment to a policy solution for disrupting the policy status-quo and willingness to invest their resources such as their time, energy, reputation and even money. They have the capability to display social acuity, define problems, build teams, and lead by example (Mintrom and Norman, 2009). They can be motivated by the expectation of a future return related to their personal or material interests, a general enthusiasm for policy advocacy, their own personality traits and value systems, or their ideological positions and visions (Kingdon, 1984, Sanz Sanz et al., 2022, Timmermans et al., 2014). The literature on policy entrepreneurs identifies them to be operating not just within the state machinery such as bureaucrats or politicians, but also within thinktanks, private sector, development organizations, and so on. This study focuses largely on the PEs operating within the government bureaucracy and highlights the wide range of opportunities and powers that government bureaucrats can have at their disposal to act in entrepreneurial ways to drive through policies and transitions.

The next section details the approach and methodology adopted for undertaking the empirical analysis.

4.3 Data and methods

This study adopts a critical realist perspective and uses a process tracing approach to investigate how and why early national policies on electric mobility were created between 2010 and 2015. It relies on interviews and data from secondary sources to conduct its investigation. Critical realism recognizes the existence of reality beyond what is empirically observable and

stresses the importance of causal mechanisms in producing events that are observed (Fletcher, 2017). Thus, it is well suited to investigate causality in sociotechnical transitions, given its focus on actors, events, causal mechanisms and structures (Geels, 2022). Process tracing originated in political science and is used for conducting detailed within-case empirical analysis of how causes are linked to outcomes through causal mechanisms or processes (George and Bennett, 2010). Unpacking these mechanisms involves breaking down the process into sets of entities performing activities that are linked in a productive relationship, such that the activity performed by one entity triggers or influences the next or other entities, and so on (Beach and Pedersen, 2019). To do this, one has to collect within-case 'mechanistic evidence', i.e., traces left by the activities of entities associated with the mechanisms, that can be discovered empirically, e.g., through analysis of minutes of meetings (Bennett and Checkel, 2015). Given this study's focus, this paper adopts an 'explaining-outcome' version of process tracing where the goal is to develop a case-specific explanation of the major factors in a case as opposed to 'theory-testing' or 'theory-building' versions of process tracing where the aim is to generalize how certain causal mechanisms may be involved in other potentially similar cases of policy development (Beach and Pedersen, 2019).

The study focuses on three main national policies/initiatives. The first is the declaration of the National Mission for Electric Mobility (NMEM) in 2011, which was the first significant instance of national policy intent in respect of electric mobility (another scheme called 'Alternate Fuels for Surface Transportation' offering subsidy for EVs preceded this mission but was insignificant given its scale and ambition – see Section 5). The second is the launch of National Electric Mobility Mission Plan 2020 (NEMMP) in 2012 that codified the aims, objectives, and modus operandi for attaining the mission. The third is the FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) Phase I scheme that built on the NEMMP 2020 and was launched in March 2015. While the three are chronologically related where one led to the creation of the next one, it is worthwhile to study their creation as there was no policy or political momentum

for them. In contrast, all policies or schemes for electric mobility that have come after these three can be attributed to the momentum created by them, particularly the FAME Phase I scheme, and are therefore not considered for this study.

The study proceeded with a mapping of hypothesized causes for the creation of the three policies through a detailed review of academic literature, government reports, press releases, annual reports of automobile firms in India, news archives on the NEXIS UK database, grey literature, and general internet search. The three policies or schemes, namely the NMEM, NEEMP, and FAME were used as keywords for searching different types of documents over the internet. First, I looked up national government documents that had reference to these keywords, which helped obtain various government reports and press releases linked to the three policies. The keywords were also used to extract news articles that referred to the policies. I also looked up the Annual Reports of a wide range of automobile firms between 2007 and 2015 for any reference of the three policies.

The mapping of hypothesized causes based on the documents led to a secondary search for various policies, schemes, notifications, press releases, and technical reports prepared by the government of India as well as non-governmental bodies, political declarations and news articles published between 2008 and 2015. This was conducted using keywords related to the hypothesized causes, including climate change, air pollution, energy security, and growth in manufacturing. Finally, post interviews, I looked up specific documents that were brought up in the interviews but had not been collected during the first two stages, and collated data from different online sources including data on sales of electric vehicles in India, year of incorporation of various EV manufacturing companies, and number of tweets put out by India's Minister for Road, Transport and Highways on electric mobility to support the empirical analysis. The list of secondary data used to build various parts of the empirical analysis and support the findings from the interviews is listed in Table 6.

The mapping of hypothesized causes helped identify potential actors within various organizations that might be able to throw light on which of the potential causes were actual causal factors and what causal mechanisms linked those factors to the outcome. Thereafter, through principles of purposive sampling, a list of interviewees was drawn up. In total, 22 persons were interviewed (see Table 5), with 18 being online and 4 in person. The interviews typically lasted 45-60 minutes and were semi-structured, covering broad themes whilst leaving room for the participants to explore issues they felt were important. The interviewees were asked about their role in the policymaking process, causal factors they believed led to the creation of the policies and the mechanisms connecting those factors to the outcome, whilst ensuring all potential causes mapped earlier were covered. The interview process was terminated once there was confidence that all the actors who had been closely or directly involved with the policymaking process and were available and willing to speak, had been interviewed. The list of interviewees included senior officials (past and present) from different ministries and departments of the national Government, a wide range of automobile manufacturing companies, various associations of automobile manufacturers and various thinktanks who had insights on the policymaking processes relevant to this study. The names and affiliation of the interviewees are not shared to protect their anonymity.

Table 5: List of interviewees and their assigned codes

Interviewee type	Codes
Senior officials from different ministries and departments of the national Government	GOV 1-9
Representatives from automobile industry and auto industry associations	AUTO 1-7
Officials from thinktanks	T 1-6

Table 6: Summary of key secondary data used in the analysis

Type of data	Data sub-type	Title of data	Institution (Year)	Document code	Bibliographic reference
Government document	Report	Eleventh Five Year Plan	Planning Commission (2008)	DOC1	Planning Commission (2008)
		National Action Plan for Climate Change	Prime Minister's Council on Climate Change (2008)	DOC2	Prime Minister's Council on Climate Change (2008)
		National Electric Mobility Mission Plan 2020	Department of Heavy Industry (2012)	DOC3	Department of Heavy Industry (2012)
		Measures for ensuring sustained growth of the Indian manufacturing sector	National Manufacturing Competitiveness Council (2008)	DOC4	National Manufacturing Competitiveness Council (2008)
		National Manufacturing Policy	Ministry of Commerce & Industry (2011)	DOC5	Ministry of Commerce & Industry (2011)
	Official notification/ communication	Inclusion of e-bus in FAME I scheme	Department of Heavy Industry (2017)	DOC6	Department of Heavy Industry (2017)
		FAME Phase II scheme launch	Ministry of Heavy Industries (2020)	DOC7	Ministry of Heavy Industries (2020)
		National Programme on Advanced Chemistry Cell (ACC) Battery Storage	Department of Heavy Industry (2021)	DOC8	Department of Heavy Industry (2021)

		PLI Scheme for Automobile & Auto components	Press Information Bureau (2021)	DOC9	Press Information Bureau (2021)
		Sanction for continuation of the Programme of Alternate Fuels for Surface Transportation in New Technology Group for the year 2009-2010	Ministry of New and Renewable Energy (2009)	DOC10	Ministry of New and Renewable Energy (2009)
	Press release	Setting up of National Mission for Electric Mobility	Press Information Bureau (2011)	DOC11	Press Information Bureau (2011)
		FAME Phase 1 scheme	Press Information Bureau (2019)	DOC12	Press Information Bureau (2019a)
		National Mission on Transformative Mobility and Battery Storage	Press Information Bureau (2019)	DOC13	Press Information Bureau (2019b)
		National Manufacturing Competitiveness Council	Press Information Bureau (2016)	DOC14	Press Information Bureau (2016)
	Court ruling	Court on its own motion v. State of Himachal Pradesh and others	National Green Tribunal (2014)	DOC15	National Green Tribunal (2014)
Political declaration		Indian National Congress	Indian National Congress	DOC16 – DOC18	(Indian National Congress,

		manifesto for national elections	(2009, 2014, 2019)		2009, 2014, 2019)
		Bharatiya Janata Party manifesto for national elections	Bharatiya Janata Party (2009, 2014, 2019)	DOC19 – DOC21	(Bharatiya Janata Party, 2009, 2014, 2019)
Non-governmental publication		Mobility Crisis: Agenda for Action 2010	Centre for Science and Environment (2010)	DOC22	Narain et al. (2010)
		Status of electric buses in India	Institute for Transportation and Development Policy (2022)	DOC23	Singh et al. (2022)
News reports		e Vitara to electrify Maruti's EV dream in India	India Today (2024)	DOC24	Singh (2024)
		Switch to clean vehicles or get bulldozed: Nitin Gadkari tells automakers	Hindustan Times (2017)	DOC25	Hindustan Times (2017)
		India was not badly affected due to economic downturn: PM	The Economic Times (2009)	DOC26	PTI (2009)
Dataset		List of companies related to EV manufacturing registered year-on-year (Source:)	SMEV (2024); Ministry of Corporate Affairs, Government of India (2024)	DS1	(SMEV (Society of Manufacturers of Electric Vehicles), 2024, Ministry of Corporate Affairs, 2024)
		EV sales data across various modes	EVs in vehicular sales across	DS2	Clean Mobility Shift (2024)

			different modes (Source: Clean Mobility Shift (2024))		

Using NVIVO Pro version 12.6.0, every cause and causal mechanism cited in the interviews was created as a node. Thereafter, relevant sections of each interview pertaining to each cause and causal mechanism were coded against the nodes so as to gather in one place the claims of all interviewees regarding any specific cause or mechanism. Press releases, policies, technical reports, schemes, manifestos, etc. were also used to code the mechanisms where relevant information from these documents was mapped against findings from the interviews. This then enabled identification of various causal factors. Time-series data analysis was conducted on quantitative data like annual news reportage, number of new EV manufacturing companies registered annually, annual EV sales data and number of EV-related tweets put out annually. Section 4.4 presents and discusses the findings from the analysis and Section 4.5 presents some conclusions from the study.

4.4 Results and discussion

A review of some of the key policy and political documents from around 2010 reveals two key insights. First, there were multiple landscape developments related to the ICEV regime around that time, including global warming, urban air pollution, energy security, economic growth, and unemployment. Secondly, however, no linkage was being made by relevant actors between these landscape developments and a potential regime change to electric mobility, as explained below. For instance, in 2008, the Eleventh Five Year Plan (FYP) was published [DOC1]. This was a Soviet-style national planning document published every five years by the central government since 1951, considered the key repository of the government's strategies on all types of policy issues, and whose preparation involved extensive consultations with a very wide range of

stakeholders. The 11th FYP discusses at length issues of climate change, energy security, urban air pollution, economic growth, and unemployment. However, there is no mention of electric mobility throughout the document. Another significant indicator is the political manifesto of the two main political parties at the centre for the 2009 national elections, the incumbent Indian National Congress (INC) that got elected for a second term in 2009, and the opposition Bharatiya Janata Party (BJP) whose government later came to power in 2014. The manifestos of both parties discussed plans to address issues of climate change, energy security, economic growth and unemployment, but did not mention electric mobility as a potential strategy for any of the issues [DOC16, DOC19].

This pattern holds for key sectoral documents as well from around that time. For instance, the National Action Plan for Climate Change (NAPCC) launched in 2008, the Government of India's first policy document on the subject, made no mention of electric mobility as a potential alternative to the ICEV regime [DOC2]. Similarly, a key report published on vehicular pollution by one of India's foremost environmental advocacy thinktanks in 2010 [DOC22] made no mention of electric mobility either. Finally, a report prepared by a high-powered group constituted by the then Prime Minister to look into the measures for ensuring growth of the manufacturing sector did not touch upon EVs [DOC4].

Landscape developments aside, e-car, e-2Ws, and e-bus niches barely existed around 2010. Within the EV market, 3 models of electric vehicles were commercially available from major manufacturers at the time: Reva (a compact 2-seater electric car powered by a lithium-ion battery) in the electric car segment sold by the Reva Electric Car Company since 2001, the first EV sold commercially by an Indian company (later acquired in 2010 by Mahindra & Mahindra, one of India's auto industry's major companies), and one electric scooter each from Electrotherm and Hero Electric, both of which had been set up in 2008 [DOC3: p. 96].

Nonetheless, a coalition of ICEV regime actors within the Government of India's Department of Heavy Industries (DHI), which is tasked with promoting (amongst other things) India's auto industry, and the SIAM, took the lead in creating a set of policies and schemes on electric mobility between 2010 and 2015, which laid the basis for multiple other policies and government schemes that came up since 2015. During 2010-2020, a number of developments happened in relation to electric mobility in India: (a) multiple EV niches developed; (b) ICEV regime actors began to adjust with many major auto manufacturers declaring their foray into EVs; (c) political buy-in in electric mobility increased; and (d) electric mobility entered the common consciousness and public discourse. This begs two questions. First, to what extent did the creation of early policies effectively kickstart and thereafter drive India's transition to electric mobility? And second, how did the regime actors create those policies? To address the first question, the unfolding of India's transition to electric mobility along five dimensions – policy, industrial development, commercial sales, discursive embedding and political buy-in – is considered in Section 4.4.1, and the second question in Section 4.4.2.

4.4.1 Early years (2010-2015) of India's transition to electric mobility

After the creation of the NMEM in 2011 [DOC11], the NEMMP 2020 was launched in 2012 [DOC3]. The NEMMP 2020 targeted a sale of 6-7 million electric and hybrid vehicles by 2020. It codified the aims of the NMEM and provided a detailed framework for attaining the target it set out. Building on the NEMMP 2020, the Faster Adoption and Manufacturing of Electric (and Hybrid) Vehicles (FAME) Scheme was created in 2015 that aimed to enhance demand through consumer subsidy and technology development. The scheme, initially slated for a period of 2 years, ran for a total of 4 years through multiple extensions [DOC12]. Several changes were also made in the scheme during period, notably the removal of "mild hybrid"[7] vehicles from and the inclusion of fully electric buses [DOC6]. Following the wrap up of FAME scheme Phase I in

[7] A type of vehicle that has an electric motor but no electric-only mode of propulsion.

March 2019, Phase II was launched in April 2019 with a higher ambition, focused scope, and substantially higher commitment of funds [DOC7]. Phase II was primarily aimed at end user subsidy and targeted electrification of public transport, commercial passenger vehicles and 2Ws, with some funding also available for public charging infrastructure development. Later in 2019, two supply-side schemes were launched: a Performance Linked Incentive (PLI) scheme for advanced automotive components that supported the automotive industry in its transition to electric mobility, and a PLI scheme for advanced chemistry cells that sought to create a large-scale battery manufacturing industry in India to support electric mobility [DOC8, DOC9]. In parallel, since the creation of the FAME scheme in 2015, several state Governments came up with their own policies on electric mobility that aimed at supporting the growth of electric vehicles (EVs) manufacturing in their states along with additional consumer subsidies for purchasers of EVs. Figure 7 provides a timeline of major national policies on electric mobility between 2010 and 2021.

The national policy thrust helped create multiple niches for EV manufacturing in India (Dutt, 2023). There has been a rapid growth in electric 2Ws and electric 3W manufacturers in India since the launch of the FAME Scheme in 2015 (see Figure 8). Further, ICEV regime actors have started to make adjustments with most ICEV manufacturers now working on launching EV models. An official from Ashok Leyland, one of world's largest bus manufacturers with almost 26% market share of bus sales in India in 2019-20 (Sathiamoorthy et al., 2021: p. 7), stated that their foray into electric buses was prompted by the FAME Phase I scheme. An official from Hyundai, which had the second highest market share in car sales in India in 2023 (14.7%) after Maruti Suzuki (which had 41.6%) (Statista, 2024), also cited the national policy focus as the reason for bringing their existing EV technology to the Indian market. Maruti Suzuki itself, having been openly sceptical of a transition to electric cars, shifted its stance after 2019 and the launch of FAME Phase II scheme. It now aims to launch its first electric car by 2025 [DOC24]. The fact that interest in electric cars among a few major auto manufacturers like Tata Motors

and Mahindra & Mahindra preceded the national policies does not undercut the influence of national policies on the overall ICEV industry in India. For one, as one interviewee from Tata Motors noted, their early interest in electric cars was primarily for markets in northern Europe. Moreover, their strategic moves towards EVs did not prompt action from their competitors such as Maruti Suzuki, Hyundai, Honda, and Ashok Leyland until the national policy movements on electric mobility intensified during 2010-2015.

The introduction of subsidies under the FAME scheme led to a growth in EV sales. EV sales in various vehicle categories have risen considerably since 2015, most notably within the e-bus and electric 2W segment, though EV sales still remain a small percentage of overall sales for all vehicular categories other than 3Ws (Figure 9). Further, electric mobility has also become increasingly embedded in news discourse after 2015, indicating a strong correlation with national policy developments. For example, data on the number of news articles from five of India's most circulated English newspapers (The Times of India, Hindustan Times, The Indian Express, The Hindu and The Telegraph) that featured "electric vehicle" in their headline and body reveals a sharp increase after 2015 (Figure 10).

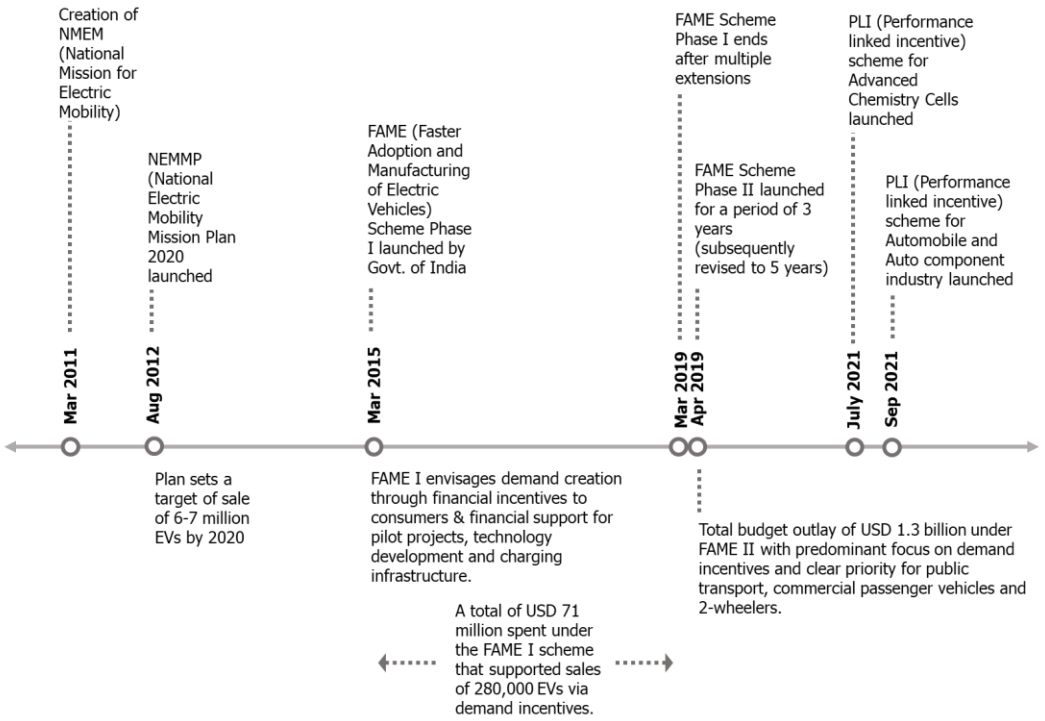

Figure 7: A timeline of major national policies and schemes for promotion of electric mobility launched by the Government of India between 2010 and 2021

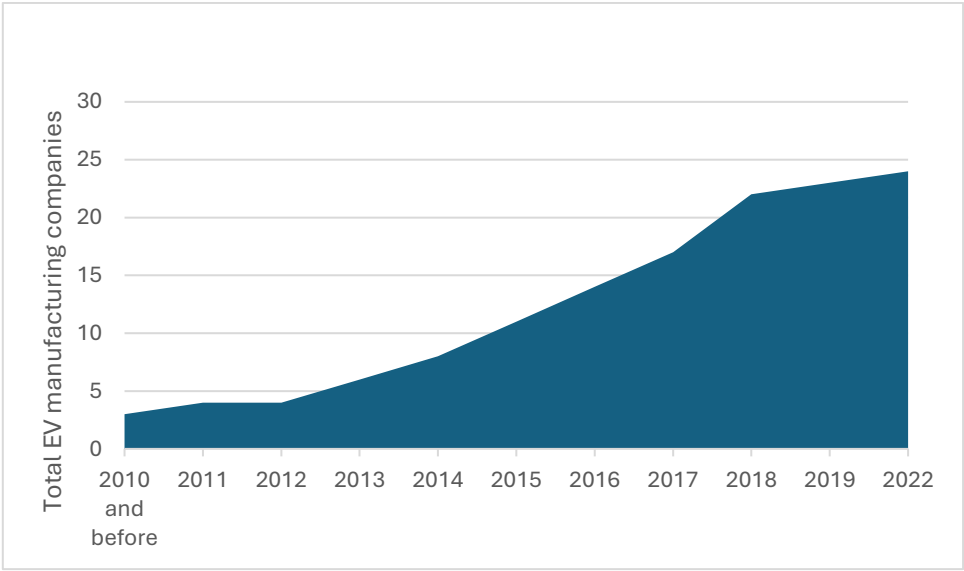

Figure 8: Total new companies related to EV manufacturing registered year-on-year (Source: SMEV & Ministry of Corporate Affairs, Government of India)

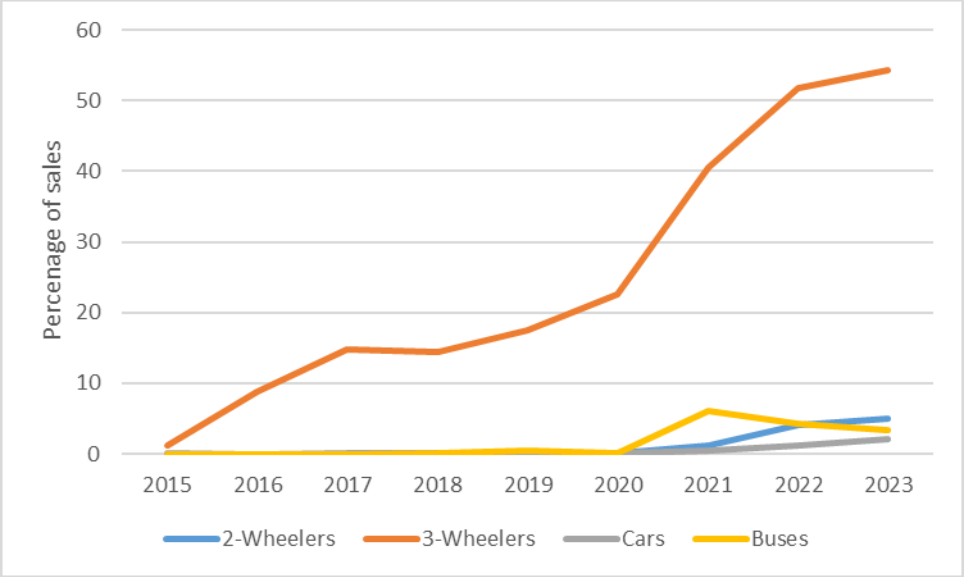

Figure 9: Diffusion of EVs in vehicular sales across different modes (Source: Clean Mobility Shift (2024))

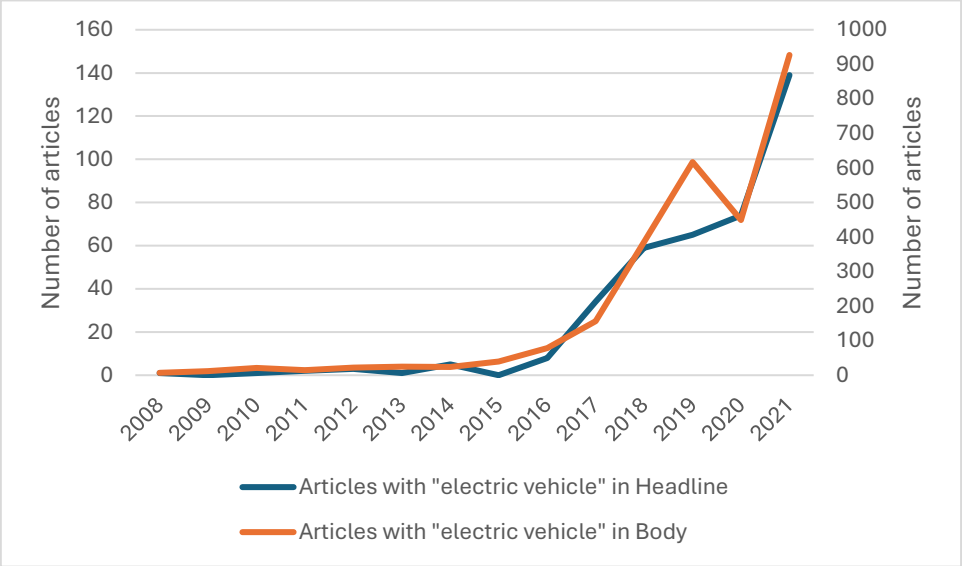

Figure 10: Embedding of electric mobility in the English print news media discourse in India (Source: NEXIS UK database)

Beyond public discourse, electric mobility has also seen buy-in by the political class since 2015. It was, for instance, incorporated within the manifestos of both the BJP (the ruling party at since 2014) and the INC (BJP had ousted an INC led coalition in 2014) for the 2019 national elections in India [DOC18, DOC21]. One of the most significant moments was a dramatic

statement made by the national Minister for Transport, Mr. Nitin Gadkari, at the annual SIAM convention in September 2017. He spoke about his vision to have only electric vehicles being sold in India from 2030 and his intent to "bulldoze" the auto industry into achieving this vision [DOC25]. While he later softened that stance after significant push back from India's auto industry, his statement, and the response it generated laid down a marker for political interest in electric mobility. As his Twitter activity suggests, his interest in electric mobility increased substantially since 2015, the year of launch of FAME Phase I scheme, with no tweets on electric mobility from his account prior to 2015 (Figure 11).

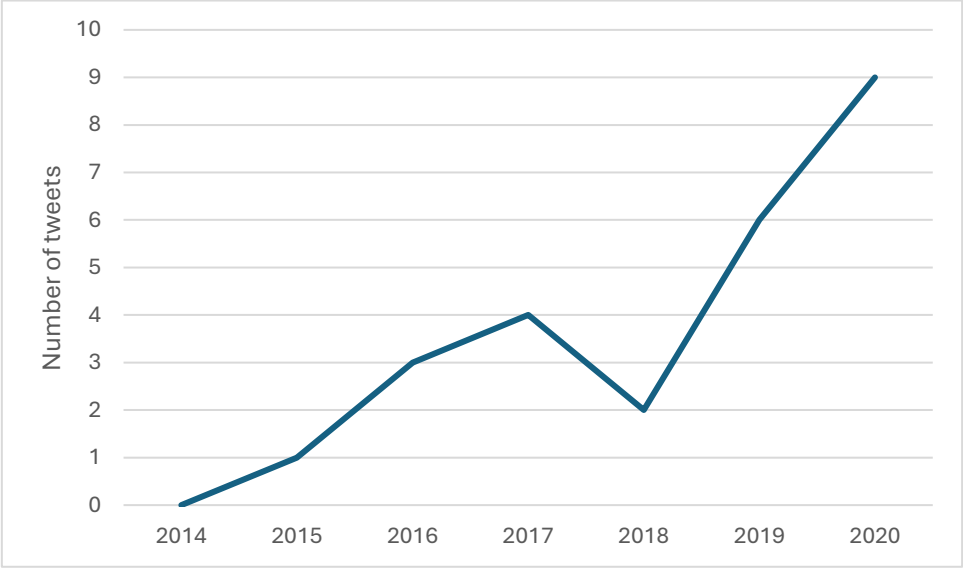

Figure 11: Tweets about electric mobility by Govt. of India's Transport Minister's own X (formerly Twitter) handle (@nitin_gadkari) (Source: X (formerly Twitter)

Another indicator of political interest has been the increased involvement of NITI Aayog (National Institution for Transforming India). NITI Aayog is a National Government agency that in 2014 replaced the erstwhile Planning Commission, a Soviet-style central planning institution that had been in place since 1950. Created as a public policy thinktank of the Central Government, NITI Aayog was emblematic of radical changes in India's national governance framework brought in by the Modi Government. While electric mobility has been the subject domain of the Ministry of Heavy Industries since the beginning, NITI Aayog has increasingly

become central to the Govt. of India's electric mobility strategy over the past few years with electric mobility included as one of the 28 'verticals' or departments of the agency. This can be linked to the creation of a National Mission on Transformative Mobility and Battery Storage launched by the Govt. of India in 2019, with NITI Aayog being tasked with the administration of the mission [DOC13]. This co-option of electric mobility by NITI Aayog is politically significant because of the agency's proximity to the Prime Minister's Office, with the Prime Minister being the Chairperson of the agency. As one interviewee (T3) remarked, "*India's electric mobility agenda is now being driven directly from the PM's office*".

There are clear correlations, if not causal linkages, between national policy developments between 2010 and 2015 and the industrial expansion, diffusion of EVs within the fleet, discursive embedding, and the increase in political buy-in of electric vehicles between 2010 and 2020. Viewed in MLP terms, it points towards an incipient sociotechnical transition with changes being observed along the dimensions of markets, politics, discourse, and industry.

4.4.2 Policy entrepreneurship and the discursive construction of landscape pressures

Process tracing analysis indicates that India's early electric mobility policies were not a serendipitous chain of events, developments in other policy domains and ongoing issues in national politics, but rather a case of policy entrepreneurs coupling the problem, policy, and politics streams to create the early policies and putting electric mobility firmly onto the policy agenda of the Indian government (see Figure 12). Within the problem stream, the need for expanding India's manufacturing sector had been well established. The INC-led coalition government that came to power at national level in 2004 created the National Manufacturing and Competitiveness Council (NMCC) chaired by a cabinet minister-rank person and tasked it with promoting the growth of India's manufacturing sector [DOC14]. The NMCC published a report in 2008 on this subject and later assisted in the creation of a National Manufacturing Policy in 2011 [DOC4, DOC5]. Within the policy stream, the DHI had hosted a United Nations

Environment Programme (UNEP) conference on energy efficient vehicles in 2008, during which global developments in emerging mobility technologies had been discussed. EVs in particular had piqued the DHI's interest during this conference (GOV 4-6). Elsewhere, EVs were being promoted at the time under the 'Alternate Fuels for Surface Transportation' scheme being run by the Ministry of New and Renewable Energy (MNRE), although the scope and scale of the program was very low with Rs. 2 crores (≃ USD 240,000) allocated to the programme for the year 2009-10 [DOC10]. Finally, the imminence of national elections in 2009 and National Government's concerns over economic slowdown [DOC26] constituted the political stream.

A window of opportunity opened up for coupling these three streams when NMCC staff sent a memo to DHI colleagues in 2008 recommending the exploration of EVs as an avenue for expanding India's manufacturing sector (GOV 1-3). This came against the backdrop of a 'high-powered group' headed by the chair of the NMCC, created and tasked by the central government in early 2008 which recommended steps for increasing industrial production (GOV 2-3). The memo helped the coupling of the three streams by policy entrepreneurs – officials within the DHI, SIAM, and the automobile industry – who worked to create the early policies on electric mobility starting with the declaration of the NMEM in 2011, followed by the launch of the NEMMP 2020 in 2012, and the FAME scheme in 2015.

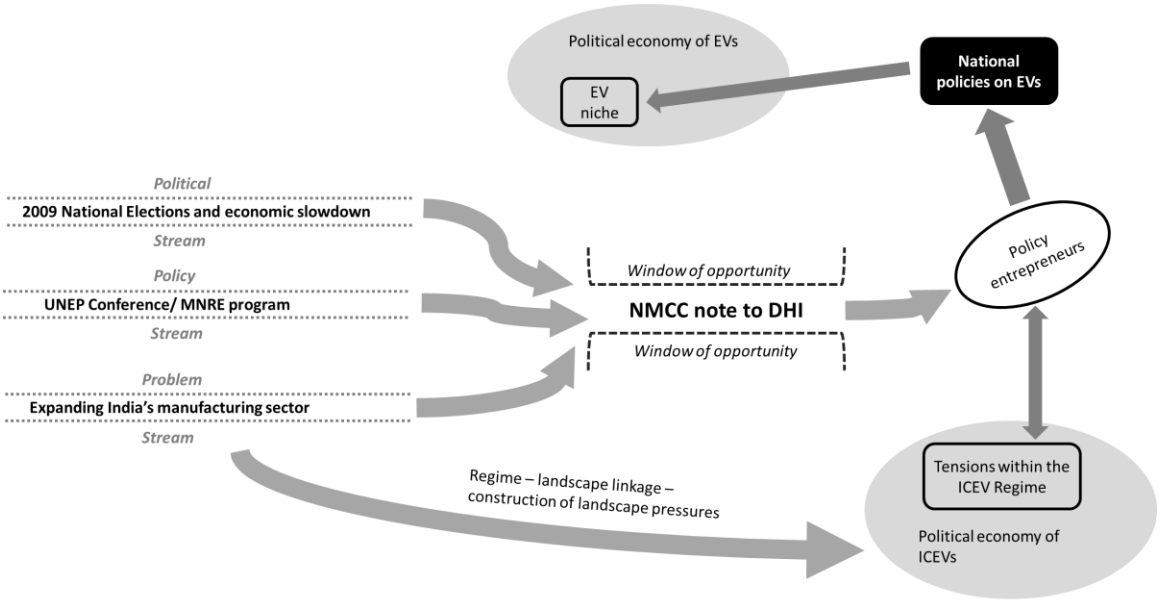

Figure 12: A schematic depiction of the process of creation of early national policies on electric mobility in India

To create these policies, the policy entrepreneurs crucially made linkages between tensions within the ICEV regime and ongoing landscape developments. Regime tensions pertained to certain political economic realities of India at the time that the PEs were acutely aware of, which was that the ICEV regime was not capable of making India a global leader in manufacturing. One interviewee (GOV 6) explained:

> "*...it was time in India also to catch up because see, we missed the bus in ICE* [internal combustion engine vehicles]. *We were always catching up with the western or advanced economies where the automotive industry was much more advanced. So, when India opened up and liberalized in early 90s, we were always catching up in terms of emissions, in terms of technology, in terms of safety of our vehicles. So, we were always about four or five years behind the advanced economies, or advanced automotive companies, even those companies who are operating now in India, the Toyotas, Hondas, and what have you, or GM, etc., but still in some ways, our regulations were always catching up with the advanced*

economies. So, we thought that at that point of time in 2009-10 I think most of the automotive industries all around all over the world were in a startup phase as far as electric mobility is concerned. So, we felt that this was a niche place where India can get into the right time, and we can almost be step for step with other automotive industries."

The PEs interpreted this tension in the regime and linked it with the ongoing demands for growing the economy and the manufacturing sector within the landscape to discursively construct a political economic pressure on the ICEV regime. This discourse is visible in the vision statement of the NEMMP 2020 that projects the EV transition to enable "*Indian automotive industry to achieve global EV manufacturing leadership*" (Department of Heavy Industry, 2012). Indeed, later on this sentiment also finds its way into political discourse, where for example, the BJP's manifesto for 2019 national elections mentions its intention to use electric mobility as one of the instruments to "*position India as a global manufacturing hub*" (Bharatiya Janata Party, 2019: p. 18).

It is useful to point out that this discourse or sentiment around EVs being a pathway to the country becoming a global manufacturing leader is not unique to India. China's transition to electric mobility was driven based on similar motivations (Lyon, 2024). However, during the interviews, it emerged that developments in China were not seen as an inspiration. One interviewee [GOV5] observed,

"*I think that [China] was a model that we did have a look at but they were operating on numbers that was hundred[s] of times ours, it was the money also, you couldn't really say that you know we can have that kind of achievement…So, I don't think we were, we saw China model, and that's where yeah we would eventually like to be, but I don't think we had the resources or the push to get anywhere there*".

As such, while discourses around EVs and manufacturing likely existed in other countries and regions, at least the connections were not being made then. India had been a late mover in developing domestic ICE vehicle manufacturing capabilities because its economic liberalization only commenced in 1991. By the time the automobile industry expanded in the country, it was too late to compete on technology development and market capture with countries with mature automobile industries like the USA, Germany, and Japan. Indeed, the sentiments around India lagging the world on manufacturing capabilities were not limited to automotives. An interviewee [GOV6] commented on how India had "*missed the bus*" on mobile phones too since, in the late 2000s, increasing domestic consumption of mobile phones was largely predicated on import.

Here a discussion on the PEs and their activities and strategies is warranted. These PEs were senior DHI bureaucrats, typically at the levels of Director, Joint Secretary, Additional Secretary and Secretary, a senior SIAM official, and a pioneer of India's EV industry. They worked on creating the policies despite there being no official onus on them to do so. Indeed, the fact they took the NMCC memo in earnest was viewed with curiosity by officials in other government departments at the time (GOV 5-6). In doing so, they invested their resources, time, energy and possibly reputation in the hope of a future return in the form of the policies they were championing. They displayed various tenets of policy entrepreneurship, though not necessarily all of them in equal measure. For instance, they displayed social acuity, i.e., they recognized the windows of opportunity and were perceptive of others in their policy context and their motives, concerns, and motivations. For instance, they consciously started working on it around 2010 at a time when there was not any direct demand for it, noting that "*normally, it takes a number of years for such new initiatives to find traction. And there is a lot of time needed for building consensus among stakeholders, not only external stakeholders, but within the government also, it's a very time-consuming activity*" (GOV 7).

They also understood that the policies would not get approved solely on the basis of EVs making India's auto sector globally competitive and helping expand India's manufacturing sector. Thus, they worked on legitimizing the policies on the basis that EVs would help address other long-standing policy issues like energy security and air pollution (GOV 4 – 6, AUTO 1-4, T 1-2). This also speaks to their skills in problem definition, i.e., deciding which attributes are foregrounded and which not, so as to enable multiple stakeholders to relate the problem to their own interests, Further, they set the ambition deliberately high (sales of 5-6 million electric vehicles by 2020), knowing fully well this was not achievable because in their view, "*without any ambition, no scheme will work, and nobody will work towards anything*" (GOV 4).

They further worked on ensuring the EV policies received as much political support as possible, such as getting them included in the budget speech of the then Finance Minister in February 2011, in the President's speech to the joint parliamentary budget session in March 2012, and the launch of the NEMMP 2020 by the then Prime Minister in January 2013 (GOV 1-3). Finally, the FAME scheme was purposefully labelled as 'Phase I' "*so that it did not generate the impression within the industry and society that 'this was it'*" (GOV 2). The approval of the FAME Phase I scheme itself demonstrates social acuity of the policy entrepreneurs. In 2014, while the scheme's details had been worked out by then, the change of reign at national level meant officials were reluctant to take a new scheme with a huge outlay (Rs. 23,000 crores ≈ USD 2.8 billion) to the new Government. One interviewee observed,

> "*...but when the plan was ready, there was a big change in the political situation and Modiji came to power, so then nobody wanted to go and bureaucrats at least didn't want to go up to him and say, look, there is a proposal for distributing 12,000 crores, right. So, they just didn't go to him*" (GOV 9).

In the absence of political approval, the FAME scheme was approved with a highly reduced outlay of Rs. 795 crores (≈ USD 96 million) through internal repurposing of DHI funds (GOV 9,

AUTO 5). This approval required considerable efforts from the officials involved at the time (GOV 8-9). The launch of the scheme, even if at a diluted level, and its labelling as Phase I, ensured that the door remained open for the officials to approach their political bosses with a more ambitious agenda later on. One interviewee noted,

> "*I think what this whole initiative did was create excitement, create understanding, create initial buzz, and create a lot of awareness within the ecosystem about something that was at that time, you know, million miles away, even globally, you know, EV was struggling at that time*" (AUTO 5).

They were also team players and worked in coalitions, recognizing that the size and composition of the coalition can demonstrate the depth and breadth of support the policies enjoy, besides noting that "*if somebody puts a spoke in the wheel, the whole approvals will come crashing*" (GOV 5). They were able to draw on their networks to bring in entities whose knowledge and skills could help them get over the line. They actively engaged a wide range of stakeholders, including all the main ministries, such as the Ministry of Urban Development, the Ministry of New and Renewable Energy, and the powerful Planning Commission (which was later dissolved and replaced by NITI Aayog). They enrolled a Joint Secretary (a middle-ranking bureaucrat in all national ministries and often the engine of policymaking) from 6-7 ministries in a committee that also included representatives from academia, the automotive industry, SIAM, the Emission Controls Manufacturers Association (ECMA), and non-profit organizations working on green vehicle technologies. Overall, the committee met around 50-60 times (GOV 1). Further, a detailed background study was conducted in partnership with SIAM to obtain up-to-date data, knowledge, and technological developments, and in the process secure industry buy-in (GOV 2-3, AUTO 3-4). Policymakers realized the engagement of all stakeholders was necessary not only for smooth approval of the mission plan (NEMMP 2020) but also to ensure the long-term success of the plan.

They also led by example, taking action to demonstrate the workability of the policies in order to reduce the perception of risk for decision makers. A relevant example is the successful implementation of electric buses in Rohtang Pass, a prime tourist location in north India at an altitude of 6000m. In early 2010s, air pollution from jeeps and buses had started to turn the snow cover black near the pass, and by 2014 this had attracted the attention of the National Green Tribunal (NGT), a judicial body set up in 2010 through parliamentary legislation for adjudicating on environmental issues and disputes in the country [DOC15]. After early measures aimed at curbing vehicular traffic failed, the NGT summoned DHI officials in November 2015 and tasked them to find out if it was possible to run electric buses there.

Subsequently, DHI officials sought and received a unanimous negative response from leading Indian bus manufacturers. Unwilling to give up, the officials looked at examples of implementation of electric buses in China and spoke to other industry representatives who had ties with the Chinese industry. Eventually, they learnt the operation was feasible subject to a significant government subsidy. The officials took a leap of faith, recognizing that the entire future of EVs in India could be at stake if the idea of operating electric buses in Rohtang Pass did not see the light of day (GOV 8-9), with one interviewee (GOV 8) noting the deployment of e-buses in Rohtang as "*the turning point for electric mobility in the country*". Subsequently, an RFP (request-for-proposal) for 25 electric buses was issued in May 2016 with 75% of the cost being borne by the DHI, at a time when there were no existing guidelines for the DHI to fund electric buses. In September 2017, 25 electric buses, procured from BYD, a leading Chinese manufacturer of electric buses, were launched for the first time in India [DOC23]. In subsequent years, running of electric buses in Rohtang Pass would prove to be an oft-cited example and laid the foundation for future introduction of electric buses elsewhere in India.

4.5 Conclusions

This study highlights the case of electric mobility in India to demonstrate how transitions can be instigated and driven by regime actors acting as policy entrepreneurs who can construct landscape pressures on the incumbent regime and create policies to trigger the transition. From an MLP standpoint, in India around 2010, relevant actors like civil society or officials working on matters of energy security, tackling climate change, and increasing economic growth did not frame and position a transition to electric mobility as a solution to the challenges associated with those topics. EV niches also barely existed with very few EV manufacturers present in India around the time. However, a set of regime actors, officials within the DHI, SIAM and the automobile industry, interpreted tensions within the ICEV regime pertaining to its inability to meet certain political economic ambitions with ongoing landscape developments related to the demand for growth in economy and manufacturing, thus discursively constructing a political economic landscape pressure on the regime. They used this pressure to create the early national policies on electric mobility which triggered the transition in the years after.

The strategies adopted by these actors to make the regime-landscape linkages can be understood using the lens of policy entrepreneurship and the multiple-streams-framework, whereby they utilized a window of opportunity to couple the three streams, the problem stream comprising the need for expanding India's manufacturing sector, the policy stream comprising the potential technological alternative of electric mobility, and the political stream comprising the imminence of national elections and the national government's concerns over economic slowdown. Finally, the need for entrepreneurial strategies can be understood as a consequence of them being a part of the incumbent regime, such as cognitive rules that placed no onus on the regime actors to push for electric mobility and made their actions appear strange to their peers.

Based on these findings, this study is able to advance the theoretical underpinnings of the research in multiple ways. Firstly, the study adds to the literature on the dynamics of landscape pressures in sociotechnical transitions by demonstrating how regime actors too can interpret landscape developments and link them with regime tensions to construct landscape pressures, in the absence of actors at the niche (Antadze and McGowan, 2017) or indeed landscape level undertaking that action. Secondly, it contributes to growing literature examining the blurring of lines between transition actors at the three levels of the MLP (Dutt, 2022b). While a lot of literature has often engaged with this theme in the context of regime and niche actors (e.g., Berggren et al., 2015), this study adds a new dimension by showing how regime actors can also act as landscape actors, a category of transition actors that has been under-theorised in transition literature (Kivimaa and Sivonen, 2024).

Thirdly, this study helps understand one of the ways in which the MLP and MSF can be brought together to advance the understanding of transition dynamics in a meaningful manner (Benvenutti et al., 2023, Derwort et al., 2022, Arslangulov and Ackrill, 2024). By understanding the problem stream as comprising the problematisation of certain landscape developments, the actions of transition actors can be understood in two complementary ways: viewed from the MLP perspective, transition actors can use a window of opportunity to link the problem stream with tensions within the regime to construct landscape pressures for transition, while from the MSF perspective, they couple the problem, policy, and political stream to create policies favouring a sociotechnical innovation that could trigger a transition. Moreover, policy entrepreneurship traits and strategies can manifest in the way the actors navigate the incumbency that regime rules create to constrain transition activities.

Finally, this study demonstrates the importance of context in the role that different types of policy entrepreneurs can play in effecting change through policy (Bakir and Jarvis, 2017, Henderson, 2019). The context can be access to wide range of powers, knowledge, and

opportunities to actors for navigating the policy machinery as well as complementarity with the structure that the actors are embedded in. For instance, knowledge about availability of funds that could be repurposed to launch the FAME scheme that would have otherwise languished, and the power to do so was a contextual factor that would not have been applicable to other types of policy entrepreneurs, such as civil society actors. Similarly, it helped that the policy entrepreneurs were embedded within the Ministry of Heavy Industries, whose overarching aim, to promote the industrial development of India, provided a degree of legitimacy to their actions.

CHAPTER FIVE: ELECTRIFICATION AND THE POLITICS OF MULTIMODAL PASSENGER MOBILITY SYSTEMS IN INDIA

Abstract

Electrification has become the central strategy for decarbonization of India's transportation sector in the last few years. Sociotechnical transitions scholarship has started to examine the interrelationship between this ongoing transition and the politics of passenger mobility systems in India. This study contributes to this emerging literature. Using the lens of sociotechnical imaginaries, it focuses on different mobility futures potentially attainable through electrification that are reflected in the priority accorded to electrification of different modes. By employing an approach informed by Critical Discourse Analysis, the study investigates which of the different futures are legitimized and which are delegitimized by the news media discourse, and how this is linked to the politics of passenger mobility. The study finds two contrasting imaginaries, one of 'environmentally friendly automobility' and another of 'electrification of rickshaws for employment'. The first imaginary is a vision of a desired mobility future centred around unfettered growth of cars that is supportive of and supported by electrification through removal of constraints on the growth of automobility like air pollution and CO_2 emissions. The second imaginary of 'electrification of rickshaws for employment' is a vision of a desired mobility future where unfettered growth of e-rickshaws is not permitted (in contrast to e-cars) and the provision is this form of transport is rather imagined as a source of employment. In combination, the two imaginaries allow electrification to reinforce the entrenchment of automobility at the expense of other transport modes. The electric mobility transition is thus assimilated into the prevailing politics of passenger mobility systems in India.

Keywords: electric mobility, discursive politics, sociotechnical imaginaries, India, critical discourse analysis, automobility

5.1 Introduction

Between 2005 and 2019, CO_2 emissions from transport in India increased by 168%, increasing India's overall CO_2 emissions by 115%, almost five times the growth of global CO_2 emissions over the same period (IEA, 2022). This can be attributed to a staggering growth in motorization levels in India, which saw a 230% increase in registered vehicles during that period (Government of India, 2021). With motorization levels expected to grow further in the coming decades, electrification has become a key strategy for decarbonization of India's transportation sector (Government of India, 2015). Since 2010, there have been increased policy efforts at the national level to facilitate and accelerate a transition to electric mobility in India. The electrification of public transport, shared mobility, and commercial vehicles has been given particular attention since 2019. Policy focus has contributed to the growth in electric vehicle (EV) sales over time, although the adoption rates still appear modest when considering the proportion of total vehicle sales, except for 3Ws (see Figure 13). Moreover, sales trends vary across different modes, which connects with the central premise of this study, i.e., the intersection of transition to electric mobility with the India with the multimodal passenger mobility system.

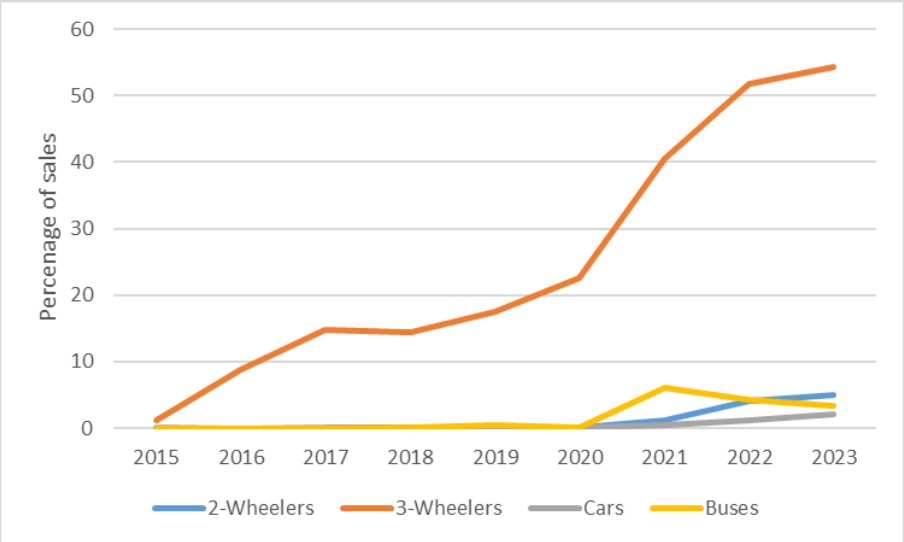

Figure 13: Share of EVs in total vehicular sales across different modes between 2015 and 2023

Source: (Clean Mobility Shift, 2024)

The bulk of academic literature takes a techno-economic view of this sociotechnical transition, offering useful insights into pathways for acceleration of the transition and management of its impacts. This includes enumeration and prioritization of 'constraints' or 'barriers' and 'enablers' of the transition (e.g. Digalwar et al., 2022), quantification of the impacts of electric mobility on the environment (e.g. Dhar et al., 2017), examination of interrelationships between India's energy system and growth of electric mobility (Rajagopal, 2023) and assessment of charging infrastructure requirements and methods of its deployment (Desai and Patel, 2023). However, literature on electric mobility in India has only recently started to engage with the inter-connections between electrification and the politics of passenger mobility systems in India. For instance, Dutt (2022a) has analysed the complex and messy politics of transition in informal transport modes, while chronicling the growth of electric rickshaws (e-rickshaws) in India that went from unregulated growth to a phase of vilification to finally being accommodated within the regulatory framework as a result of electoral politics. While he describes e-rickshaws' vilification, he stops short of linking that to the inherent politics of passenger mobility systems and how that can shape, and be shaped by, electrification.

Passenger mobility systems in India are multimodal where each mode, striving for priority, sustenance or merely survival, represents one or more competing interests (cf., Gopakumar, 2020). Politics lies in the process through which trade-offs between these competing interests are negotiated, managed and resolved (DeSombre, 2020), and in which some are prioritized over others, which in turn has significant social and environmental consequences. A transition to electric mobility can end up prioritizing some of the interests associated with passenger transportation while underplaying others. This politics is intertwined with imaginations of mobility futures that transitions like electrification invariably instigate. Our imaginations of the future shapes the priorities we accord in the present, just as prioritisation in the present helps legitimise, embed, and prime for realisation of some futures over others. Discourse, here understood as a particular way of thinking and talking about an issue (Geels and Verhees,

2011), remains a key component of how this politics is enacted. News media discourse is particularly important as it helps frame problems in particular ways (Vigar et al., 2011), makes certain voices visible and others invisible, and can help legitimize certain trade-offs while delegitimizing others.

In this context, this study investigates which potential futures for urban e-mobility in India are legitimized by the news media discourse? It also considers how these processes of legitimization are linked to the politics of passenger mobility? The study employs the concept of 'sociotechnical imaginaries', or normative visions of a desired future supportive of and supported by technology (Jasanoff, 2015), and is informed by Critical Discourse Analysis. The key contribution of the paper is to demonstrate one of possibly multiple ways in which the politics of passenger mobility is going to shape the transition to electric mobility. Thus, it responds to calls to address literature gaps related to the politics of mobility transitions and the politics of transitions in geographies like India (Schmid et al., 2021). The next section explains the theoretical and analytical framework that this study employs. Section 5.3 discusses the data and methodology used for analysis. Section 5.4 presents the results from the analysis, while 5.5 reflects on those findings and offers conclusions.

5.2 Theoretical and analytical framework

The study employs sociotechnical imaginaries (STIs) as a conceptual framework to investigate the connections between the discourse on electrification and the politics of passenger mobility. STIs fit within the wider scholarship on visions and imaginations of technological futures that are considered integral to sociotechnical transitions (Sovacool and Brossmann, 2013, Sovacool et al., 2020a). For instance, studies on Strategic Niche Management and Transition Management have shown that strategic deployment of technological visions guides the development of niche-innovations (e.g. Kemp et al., 1998, Loorbach et al., 2008, Rotmans et al., 2001, Schot and Geels, 2008). Similarly, early work on the sociology of expectations identified

the role of collective visions in providing transition actors with ideas of attainable futures and the means to achieve them (Berkhout, 2006, Borup et al., 2006). Importantly, those visions have normative elements: the technological future needs to be morally acceptable for a diverse range of actors to believe in it.

Sociotechnical imaginaries bring the normative element of visions of socio-technical futures to the centre, by linking the role of technology with attaining desired social futures. The concept builds on the social imaginary, which refers to the underlying sense of common understanding that enables society to undertake the collective practices that make up social life (Anderson, 1991, Taylor, 2004). These imaginaries guide societies' vision of themselves and their futures, and thereby influence collective behaviour, decision-making, and policy. Thus, engagement with social imaginaries has been argued to be necessary for addressing climate change (Herbert, 2021, Leahy et al., 2010, Pellegrini-Masini et al., 2020, Stoddart et al., 2020, Stoddard et al., 2021, Wright et al., 2013) as these imaginaries help societies prioritize values that are aligned with sustainability, shape their ability to undertake collective action to mitigate climate change, question dominant narratives of social life, and reimagine alternative futures. Sociotechnical imaginaries help to foreground the role of science and technology in shaping the future based on collectively held ideas of desired futures (Jasanoff and Kim, 2009, Jasanoff and Simmet, 2021).

Thus, STIs are defined as "collectively held, institutionally stabilized, and publicly performed vision of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (Jasanoff, 2015: pp. 4). They are collective and hence held diffusely within society. They are publicly performed across mediums such as media discourse to gain cultural legitimacy and eclipse contesting imaginaries. Most importantly, they are visions about sociotechnical futures that are at once shaped by ideas of a desired social order and at the same time help to create that

desired social order (Jasanoff and Kim, 2009, Jasanoff and Simmet, 2021). They can emanate from individuals or small groups and gain legitimacy through the exercise of power or coalition building. Multiple imaginaries can coexist either in tension or in a productive dialectical relationship whereby some could be made dominant by institutions of power such as governments, media, or the judiciary. They are durable, yet temporally situated, i.e., are more than just ideas at a given point in time and yet cannot be considered independently of the time in which they are situated (Jasanoff, 2015). Finally, there is also a scalar nature to STIs where different imaginaries can exist at different spatial or governance levels. In such cases, national imaginaries may not always be powerful at local levels where socio-material realities may lend weight to alternative imaginaries (Mutter, 2019).

Transition scholars have increasingly deployed the sociotechnical imaginary concept in recent years to illuminate issues of transition politics. For instance, in a study on competing sociotechnical imaginaries of biogas use and electric vehicles (EVs) in Sweden, Mutter and Rohracher (2022) note that the imaginary of biogas use is fairly fragmented, spatially bound by virtue of being embedded in local socio-material systems of resource use, and associated with ideas of limitation to mobility. The imaginary of EVs, they note, is largely coherent, less disputed and associated with no restrictions on ever growing transport demands. They argue that imaginaries of electrification will begin to dominate imaginations of possible and desirable mobility futures.

Elsewhere, Martin (2021) has argued for paying more attention to how the foregrounding of certain sociotechnical imaginaries may constrain deployment of autonomous vehicles (AVs) for a more sustainable future, such as shared autonomous mobility, and enable AV futures that simply replace existing car systems. Common to these and other studies (e.g., Valdez et al., 2019) is a focus on how imaginations of desired mobility futures can shape the way sociotechnical transitions reconfigure or perpetuate the relative dominance of automobility

within passenger transport systems. This resonates with the current study's purpose of highlighting the connections between the politics of passenger mobility and sociotechnical transitions like electrification.

To operationalize the conceptual framework of STIs, the study builds on a recent substantial contribution to the scholarship on politics of passenger mobility in India. Gopakumar (2020) identifies automobility in Indian cities as a technopolitical constellation – a complex, multidimensional socio-material entity that enrols automobiles along with other technological, material, social and historical elements to enact specific political goals – that privileges the movement of those inside cars over other forms of mobility. Such a conceptualization of automobility centres the role of politics in cars becoming the dominant mode within the passenger mobility system. Gopakumar argues that automobility is installed through the construction of a 'regime of congestion', the assembling of 'infrastructurescapes' and the composition of an 'automobile citizenship,' which together imbue it with significant political power. The 'regime of congestion' is a structure of decision making within the policy domain with the explicit political aim of physical and discursive occupation of street space by private automobiles at the cost of poorer inhabitants of the city. 'Infrastructurescapes' are sociotechnical webs that link together physical infrastructures, actors, discourses and worldviews in power-laden purposeful ways that reinforce the practices and experiences of private car user. 'Automotive citizenship' is a mode of belonging that enfranchises car users and disenfranchises non-car users through redesigned street-side artefacts, social media platforms and traffic management policies.

The current study builds on Gopakumar's work to develop an analytical framework to investigate the sociotechnical imaginaries within the news media discourse. The discursive treatment of different transport modes undergoing electrification is fundamental to this study, which points towards 'modes' as a primary theme for analysis. However, it is also useful to

examine various elements that help constitute the politics of passenger mobility system in India to understand how the imaginaries are being constructed. Thus, drawing on 'regime of congestion', the current study puts forward 'policy and regulations' as another plausible theme in empirical analysis, where the analytical focus may be placed on how future imaginations of mobility provide discursive prominence to various regulatory and policy instruments aimed at enabling or constraining electrification of different modes. Similarly, drawing on 'infrastructurescapes', the study proposes that a thematic focus on infrastructure can help draw attention to how the provisions, or lack thereof, of new forms of infrastructure necessitated by electrification are being imagined in a way that could enable desired configurations of mobility systems in the future. Finally, inspired by Gopakumar's 'automotive citizenship' concept, the study forwards subjectivities as a fourth analytical theme that can help examine the discursive construction of the imagined or preferred subjects that would drive the process of electrification in a way that could help attain certain visions of desired future mobility system. The next section explains the data and methodology used for undertaking the analysis against these four themes.

5.3 Data and methodology

Sociotechnical imaginaries have been investigated through an analysis of 275 English-language print news media articles from three of India's most widely circulated news dailies. The decision to analyse solely English newspapers was driven by both logic and necessity. Electric mobility in India started and grew as an urban phenomenon (All India EV, 2025), though rural areas have started to catch up in recent years for certain modes (Kulkarni, 2024). This aligned with the fact that the majority readership of English newspapers in India is urban (Sarma, 2017). This logic helped justify the choice of English newspapers for analysis, particularly for the period under consideration (2009 to 2020 – see later). Regional language newspapers were also excluded because the investigation of imaginaries was intended to be conducted at the national scale.

Finally, the necessity arose from the unavailability of archives for Hindi newspapers in the NEXIS UK database that was used for extracting news articles for the analysis.

For collecting samples of news articles, three English-language daily newspapers with some of the highest readership levels in India were selected. These are 'The Times of India' (TOI), 'The Indian Express' (IE) and 'The Hindu' (Hindu). Within the English-language dailies, TOI accounted for 11%, Hindu for 3% and IE for 1% of the average daily circulations in 2020 (Registrar of Newspaper for India, 2021). Articles from these three newspapers were extracted through the Nexis UK database using a search criterion that looked for all articles that had any of the following keywords in the headline:

> "electric mobility" OR "electric vehicle" OR "electric vehicles" OR "EV" OR "EVs" OR "electric car" OR "electric cars" OR "electric bus" OR "electric buses" OR "electric 3 wheeler" OR "electric 3 wheelers" OR "electric 3-wheeler" OR "electric 3-wheelers" OR "electric rickshaw" OR "electric rickshaws" OR "e-rickshaw" OR "e-rickshaws" OR "E3W" OR "E3Ws" OR "e-bike" OR "e-bikes" OR "electric bike" OR "electric bikes" OR "e-scooter" OR "e-scooters" OR "electric scooter" OR "electric scooters" OR "electric 2 wheeler" OR "electric 2 wheelers" OR "electric 2-wheeler" OR "electric 2-wheelers" OR "E2W" OR "E2Ws"

The Nexis UK database contains articles for the selected English-language dailies for the following time-periods - TOI: January 2010 till present, IE: April 2009 till present and Hindu: April 2014 till present. Accordingly, the earliest available date for each newspaper and 31st August 2020 were picked as the outer time-boundaries for the search. The starting point of the time frame (April 2009) was also chosen to coincide with the time around which work started on creating the early national policies on electric mobility. The end date of 31st August 2020 was chosen to ensure homogeneity in news reporting patterns which were disrupted from

September 2020, when the first wave of COVID-19 hit its peak in India. All articles returned by the search were manually screened for any spurious, duplicate, or irrelevant entries and a final corpus was established, as shown in Table 7. A total of 275 news articles were analysed, around 20% of the corpus, which was deemed practical and sufficient for the study's purpose. A stratified random sampling technique based on three parameters was used: 1) proportion of the three newspapers in the corpus, 2) proportion of articles from different time-periods, and 3) proportion of articles with different foci (Table 8). Given the disproportionate share of TOI in the corpus, IE and Hindu articles were oversampled to ensure a balanced representation of the three newspapers within the sample (Table 7). The sampled articles had an average length of 656 words with a standard deviation of 174 words.

The analytical approach is predominantly qualitative, though quantitative techniques such as word frequency analysis and time-series data analysis have been used to support the findings when this was helpful. For the qualitative analysis, Critical Discourse Analysis (CDA) principles have been deployed as a heuristic tool to investigate the sociotechnical imaginaries. Much of the research into media discourse analysis in the 1980s and 1990s employed CDA (cf. Dijk, 1988), such that it has been argued to be a hegemonic framework for analysing media texts

Table 7: Total corpus and sample distribution

Corpus			Sample Distribution	
Newspaper	Total Articles - Headlines only	Proportion of Corpus	Proportion chosen for sample (275 articles)	Total articles selected for sample
The Times of India	1108	81%	50%	137
The Indian Express	195	14%	33%	92
The Hindu	68	5%	17%	46
TOTAL	1371	100%	100%	275

Table 8: Categorization of news articles based on their focus

Category of article	Description/focus of articles
Local news	EV operations or developments specific to a city or state that do not typically have any consequence beyond the cities/ states in question
Policy & regulation	Distinct policy angle, whether it be at city, state, national or global level
Technology	Technological innovations, tech conferences, research on EVs, etc.
Industry	Automobile or EV industry
Opinion	Opinion pieces, relaying others' opinions or even posing government policy in critical light
Endorsements	Endorsements of EVs by celebrities, politicians, industrialists, etc.
Economy	Links between EVs and the wider economy of cities, states or country
Events	EV rallies, Auto expos, etc.

(Garrett and Bell, 1998). CDA is a combination of critique of discourse and explanation of how it figures within and contributes to existing social reality (1989). The word critical refers to the analysis identifying connections which may be otherwise hidden from public view, such as the connections between language, power, and ideology. CDA thus helps to analyse how hidden and transparent structural relationships of dominance, power and control are expressed, constituted and legitimized in discourse (Wodak and Meyer, 2009). As discourses, including media discourse, remain a key platform where visions of desirable future are articulated (Jasanoff, 2015, Vicente and Dias-Trindade, 2021), CDA offers a powerful tool to reveal the connections between language, ideology and power in discourse that reflect the shared understandings of social life and social order underpinning the visions of desirable futures.

In the context of media discourses, the CDA of a communication event, such as a news article, is the analysis of relationships between three dimensions of that event – text, the processes of production and consumption of that text (discourse practice), and the socio-cultural context of the event (sociocultural practice) (Fairclough, 1995). This study focuses on analysis of newspaper article texts and their socio-cultural context as they are key to identifying different normative ideas that may be embedded within (or lacking from) particular representations of

social practices and the world. It examines the varying representations of different ways and forms of mobility undergoing electrification along with the associated elements of the politics of passenger mobility systems (modes, policies, infrastructure, and subjectivities). These representations help construct different visions of desired mobility futures attainable through electrification (e.g., how a focus on the (lack of) safety of charging practices of e-rickshaws can underpin visions that render growth in e-rickshaws undesirable).

Drawing upon Fairclough's (1989, 1995) work, the study deploys a linguistic approach to analysing the representations of passenger mobility in terms of modes, policies, infrastructure, and subjectivities, focusing on the vocabulary, semantics, grammar, and sentence structure and cohesion within the text. This includes examining what is being foregrounded, what is being backgrounded and what is being omitted from the text altogether. What kinds of assumptions is a reader expected to have in order to make sense of the text? What underlying practices, value systems, or societal norms are being subconsciously normalized or marginalized through the text?

NVIVO Pro software version 12.6.0 was used for the analysis. Four nodes were created against the four themes identified at the end of Section 5.2, and five sub-categories of nodes corresponding to different modes (cars, 2Ws, 3Ws/e-rickshaws, buses, multiple) were created under each node. Thereafter, all articles were coded against all nodes and the sub-nodes, and the coded texts were subjected to in-depth textual analysis as described above.

The analysis looked for various visions circulating through the discourse. However, to identify whether identified visions also qualified as imaginaries, by employing CDA principles outlined above, they were evaluated against three criteria, drawing upon the definition of STIs and the conception of politics of mobility as understood in this study. Firstly, the visions needed to have a deep normative basis, i.e., the visions were needed to be linked to deeply embedded societal ideas of desired futures. Secondly, the text needed to display a degree of performativity with

regard to the normative dimension of the vision. Finally, the visions needed to have a degree of pervasiveness across the four dimensions identified in Section 5.2, i.e., the normative element of the visions was being performed across the different dimensions.

5.4 Results

A word frequency analysis on the 275 considered articles confirms the appropriateness and prominence of the four conceptual dimensions adopted for the analysis: transport mode (reflected in words like rickshaws, buses, cars or wheelers), infrastructure (reflected in words like batteries, charging stations or infrastructure), policy and regulation (reflected in words like policy, government, court, officials or cost), and subjectivities (reflected in words like drivers, women, people or public) (Figure 14).

Two contrasting imaginaries regarding the electrification of passenger mobility system in India emerged from the analysis, one of 'environmentally friendly automobility' and another of 'electrification of rickshaws for employment'. The first imaginary is a normative vision of a desired mobility future centred on unfettered growth of cars that is supportive of, and supported by, electrification through removal of constraints on the growth of automobility like air pollution and CO_2 emissions. The second imaginary is a vision of a desired mobility future where unfettered growth of e-rickshaws is not permitted (in contrast to e-cars) and this mode of transport is rather imagined as a source of employment. Sections 5.4.1 through 5.4.4 elaborate these imaginaries on the basis of the four dimensions of modes, policies, infrastructure, and subjectivities.

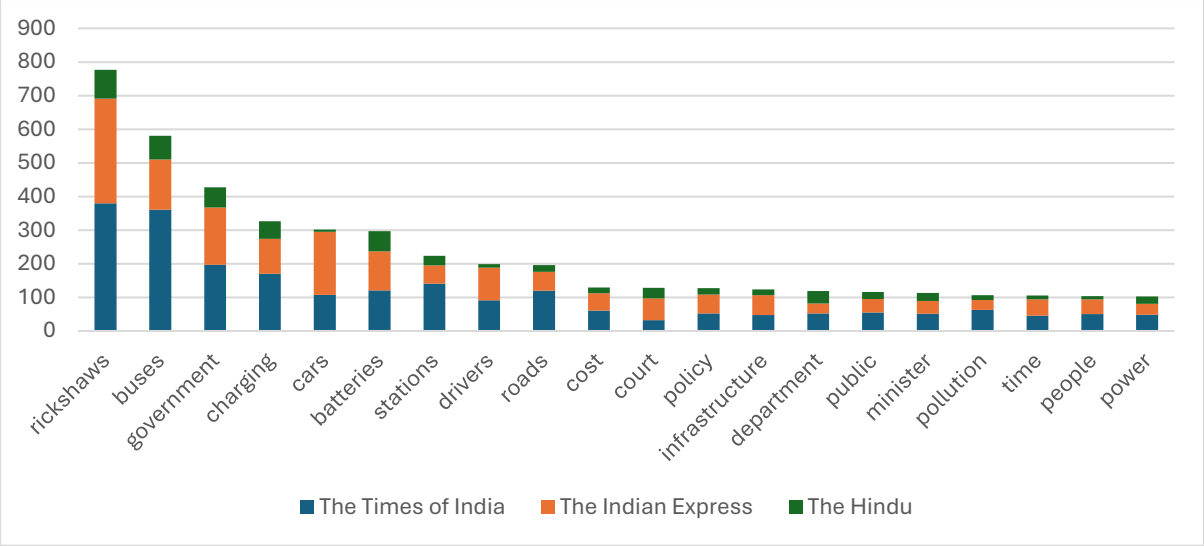

Figure 14: Top 20 keyword frequencies in the sample of articles

5.4.1 Transport modes

The imaginary around automobility comes through in various ways in which the electrification of cars is treated differently compared to that of other modes across the newspaper articles. This is not evident when the frequency of articles is considered, given that the total number and spikes in reporting per year are greater for e-buses and especially electric rickshaws (Figure 15). The differences in discursive treatment that set e-cars apart from the other modes can be seen in the discussion of system-wide changes, the scale at which electrification is discussed, and the representation of external pressures for electrification.

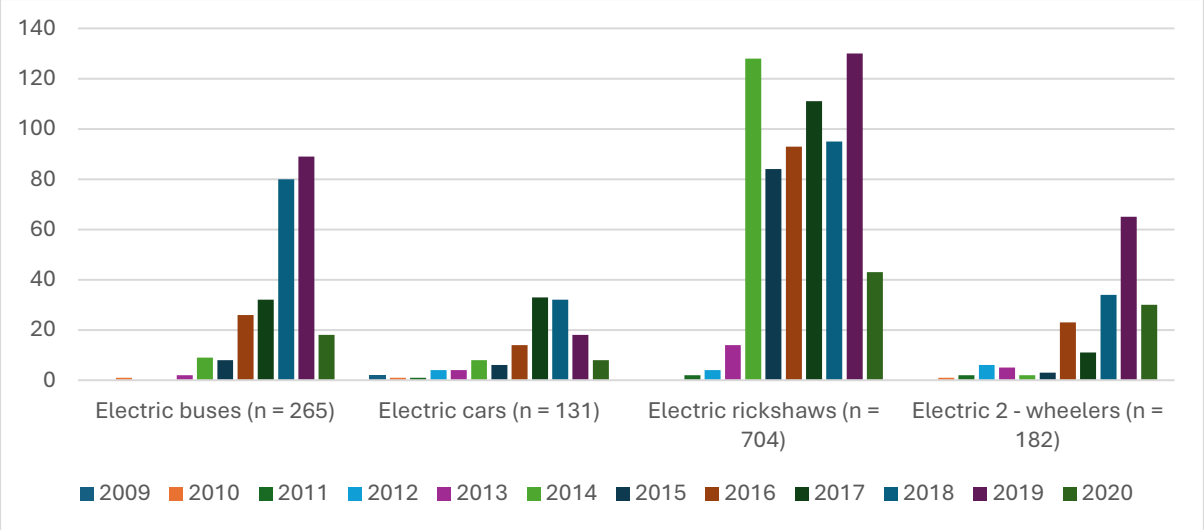

Figure 15: Articles mentioning different modes in their headlines over the years

System-wide changes are discussed only in the case of cars and 2Ws, indicating different levels of media interest in discussing the wider dynamics of electrification of different modes, that help reinforce the automobility-oriented STI. These two modes feature in all categories of articles, including local news, industry and policy-related news, and opinion pieces (Figure 16). Articles on e-cars cover a wide variety of news, including technological and market developments, industry perspectives, stakeholder opinions on barriers towards uptake, or local developments related to, say, charging infrastructure development. Opinion pieces are significantly more common for e-cars, indicating that the desire to put out 'expert' voices on the transition is largely limited to cars. In contrast, e-rickshaws (which dominate the discussion on electric 3-wheelers (e3Ws) altogether) are covered largely in articles focused on "policy & regulation" with barely any discussion on them and e-buses in industry-related articles.

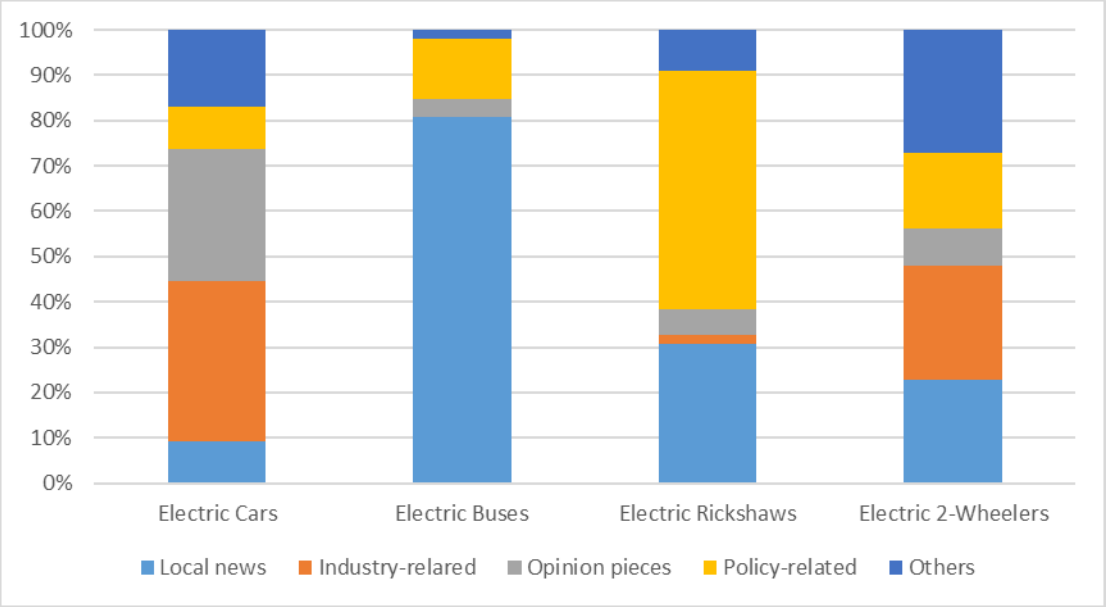

Figure 16: Discussion on electrification of the 4 modes across different categories of news articles

Another significant difference in reporting relates to geographical scale. Electrification of cars is discussed at all geographical scales, from a city (evident in the nearly 10% of the coverage on e-cars being within the 'local news' category, see Figure 16) to the global level. A typical way in which the discussion at the global scale happens is through the foregrounding of e-cars in comparisons drawn between the EV transition in India and at the global level, such as in the following text from an article discussing the need for universal charging standards:

> "*Globally, EV sales have been rising at a "fast" pace to over 10 lakh units being sold in 2017 from just over 2,000 in 2008. Over half of the sales were in China, which had a market share of around 2 per cent for electric cars. In comparison, the Indian market share of electric cars is a "meagre" 0.06 per cent*" (The Indian Express, 2019b).

Significantly, national-level ambitions for the electric mobility transition are almost invariably invoked in any discussion on e-cars. See, for example, how an opinion piece arguing for an accelerated transition to electric cars aims to set the scene by narrowing the national ambitions

in respect of electric mobility to solely e-cars: "*India plans to completely shift to electric cars and cleaner fuels in the coming years, but turns out we're slow to change our ways*" (The Indian Express, 2018b). Indeed, the transition to e-cars is often equated with the transition to electric mobility itself. For example, the Minister for Transport in the Government of India announced in 2017 that by 2030 all vehicles sold in the country would need to be electric (he later backtracked on that stated ambition after pushback from the auto industry). Representation of this political development reduces the discussion to cars: "*With the government's 2030 deadline for shifting to an all-electric car fleet for new* ***cars*** [emphasis added] *looming in the horizon, car makers have made a strong pitch for a technology-agnostic approach to the all-electric goal…*" (The Indian Express, 2018c).

In contrast, there is a high representation of e-rickshaws in the "local news" category (≈ 30% of all news articles; for cars it is ≈ 10%, see Figure 16), which indicates that electrification of 3Ws is not considered national news. Almost all of the substantial discussion on the barriers to electrification and its implications for India's associated ambitions ignores the monumental growth of e-rickshaws since 2011. For instance, as most e-rickshaws are not registered with the Regional Transport Authorities (RTOs – government agencies responsible for registering motor vehicles), there are no official statistics available. It is nevertheless estimated that India had 1.5 million e-rickshaws in 2018, which exceeded the total number of electric vehicles sold in China between 2011 and 2017 (Bloomberg, 2018). This enormous growth of e-rickshaws is seldom discussed positively in terms of its impact on and role in transition to electric mobility in India. For example, a text from a TOI article discussing the growth of EV sales in 2019-20 (see below in italics) separates the uptake of e-rickshaws from other modes by means of a paragraph break and by referring to differences in documentation. The article then proceeds to discuss some of the issues related to sales of all modes other than e-rickshaws. The discursive implication here is that e-rickshaws are not deemed crucial to the national-level transition towards electric

mobility, despite shared mobility and 3Ws being an integral part of the FAME Phase I scheme and a priority in Phase II:

> "*The EV industry sold 156,000 electric vehicles in the FY19-20. Out of this, 152,000 were two-wheelers, 3,400 cars and 600 buses. The corresponding sale for the FY 18-19 was 126,000 two-wheelers, 3,600 cars and around 400 buses making a total of 130,000 units. This growth of 20% has largely come from two-wheelers.*
>
> *This figure does not include e-rickshaw which is still largely with the unorganized sector with a reported sale of around 90,000 units. The corresponding figures of the e-ricks sold in the previous year have not been documented."* (The Times of India, 2020)

Discussion on e-buses is also disproportionately covered in "local news" (≈80% of all news articles, see Figure 16) and the news coverage is typically about the need for increasing the public transport supply in particular cities by purchasing e-buses. For instance, notice how the addition of 'in cities' in an article discussing a national government incentive scheme for e-buses serves to signal the scale at which significance of transition to e-buses is being set up for the reader: "*In a big boost to electric mobility in cities, Centre has approved the proposals from state and city transport undertakings to procure nearly 5,600 electric buses including 100 for Delhi Metro Rail Corporation*" (The Times of India, 2019a). Indeed, e-buses only received significant media attention after the Govt. of India extended the financial subsidy to city bus agencies for purchasing fully e-buses under the FAME Scheme in 2017[8] and procurement processes initiated in cities across India (as visible in a large spike in reporting between 2017

[8] The Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) Scheme launched in 2015 aimed at promoting take up of EVs largely through consumer subsidy. While initially only hybrid buses were eligible under the scheme, the rules were modified in 2017 to make fully electric buses eligible for subsidy under the scheme.

and 2018, see Figure 15). E-buses are rarely discussed outside of the context of cities where actual procurement is happening.

The final difference is in the representation of external pressures for electrification for different modes. For e-cars, the justification is framed largely in terms of air pollution reduction. For example, in an article discussing an electric car rally in Delhi, the opening sentences set up explicitly the justification for e-cars:

> "*Why do we always blame the government? Are we doing our bit? In the context of the raging debate in the national capital on pollution, a handful of citizens set out in their electric cars over the weekend to answer these questions and in a bid to break a few myths through a few firsts along the way*" (The Indian Express, 2015).

Discursive construction of e-cars as the solution to transport's environmental problems and the valorisation of e-car owners as environmentally conscious and responsible citizens paves the way for electrification to solidify automobility. In contrast, for e-rickshaws, the justification is framed predominantly in terms of their role in providing employment, while their affordability or role in contributing to air pollution reduction or providing feeder connectivity to mass transit is typically backgrounded. For instance, see how the insertion of 'always' in the first sentence serves to downplay the affordability element while 'moreover' in the second sentence seeks to foreground the employment aspect of e-rickshaws in an article discussing the enforcement of regulatory measures by the government of Tripura state: "*The authorities had always been sympathetic towards these vehicles as they were cheaper than other modes of transport. Moreover, a large number of unemployed youth were involved in this transportation to earn a living…*" (The Hindu, 2019).

Justification for electrification in terms of air pollution extends to buses too but often relies on problematizing urban transport and air pollution in a manner that backgrounds the adverse effects of automobility and vilifies buses instead. For instance, in an article discussing the near-

future introduction of e-buses in Chennai, the text: *"in order to encourage states that opt for environment-friendly public transport systems, the Centre is providing subsidy"* (The Times of India, 2017) encourages readers to infer that public transport systems in the country are not environmentally friendly in and of themselves, that the Government recognizes that, and that electrification is a step towards mitigating that situation. The fact that per passenger kilometre emissions are substantially higher for cars than for diesel buses is ignored (Ritchie, 2020), and buses are discursively placed in the category of the biggest polluters on the road, leading to comparisons of e-cars with diesel buses as against diesel cars. See, for example, the following text from a previously quoted article on an e-cars rally in Delhi:

> *"As the* [electric] *cars headed back, amid the fumes in the wake of trucks and buses on the way, and the noise of canters and tourist jeeps outside the park, the seven* [electric] *cars - others couldn't make it due to various reasons - drew curious glances as they confidently hummed on the road"* (The Indian Express, 2015).

The analysis indicates imaginations of desired mobility futures centred around electric cars which are divorced from present realities where cars have the smallest rate of electrification amongst all modes and the national policy priority is for electrification of public transport and shared modes. The news discourse around EV policies itself diverges from these ground realities as shown in the next section.

5.4.2 Policy interventions and regulations

The discourse around EV policies and regulations indicates a normative preference for unfettered growth of e-cars and reservations about e-rickshaws. This normative orientation is evident in the two contrasting foci within the discourse around policies and regulations for electric mobility: a) facilitating the electrification of cars through discussions on subsidy (and charging infrastructure – see Section 5.4.3); and b) controlling the growth of e-rickshaws. This orientation indicates the presence of two imaginaries centred on e-cars and e-rickshaws.

The discourse around EV subsidies and incentives is often focused on incentives for purchasing e-cars, marginalizing the needs of fleet operators, taxi agencies, or indeed rickshaw drivers. For example, the opening sentences of an article reporting on EV-related discussions at a major transport-policy event organized by the national government quickly reduce the need for incentives for EV transition to solely e-cars: *"…the mobility summit Move… saw a host of global CEOs asking the government for a policy roadmap towards electric and hybrid technologies, seeking incentives for them in order to hasten the movement towards cleaner* ***cars*** [emphasis added]*"* (The Times of India, 2018c). Discussion of subsidies for e-buses, where it occurs, is usually tied to local mobility or air quality demands, rather than any national ambitions around electric mobility, such as in the following sub-heading of an article discussing the start of trial run of e-buses in the city of Surat: "*The Union government's department of heavy industries had decided to supply* [i.e., subsidise the purchase of] *5,595 electric buses to 64 cities across the country, in an attempt to reduce air pollution*" (The Indian Express, 2020) Subsidies for e-rickshaws are almost exclusively spoken of in the context of employment generation. For instance, see how an article discussing the launch of 100 e-rickshaws under a government subsidy scheme in Bhopal firmly sets the rationale behind the scheme to be employment provision with the following article title: "*100 unemployed women get e-rickshaws in MP*" (The Indian Express, 2019a).

In contrast, policy-related discourse on e-rickshaws is firmly wedded to the idea of regulating and controlling the growth of e-rickshaws. Between 2010 and 2014, discussion of e-rickshaws was largely limited to issues of legality, restrictions on movement, licensing, and permit conditions. For instance, see how an article discussing a Delhi government directive to officials to count the number of e-rickshaws plying in the city uses its editorial privileges to signify the need for regulations of e-rickshaws with the following first sentence of the article: "*Regulating e-rickshaws in the city has been on top of the agenda of the authorities*" (The Hindu, 2014). With e-rickshaws getting entangled with electoral politics around the time of state government

elections in Delhi in 2014-15, the discourse gradually shifted towards promoting them as a means of employment. By 2014, drivers and other business stakeholders of e-rickshaws constituted a formidable voting bloc that no political party could afford to displease. Thus, promising regulatory changes to continue plying of e-rickshaws in Delhi became a part of the electoral strategy of political parties (see Dutt (2022a) for a detailed discussion on the evolution of policies and regulations around e-rickshaws). While the discourse has moved from banning to regulating e-rickshaws, it clearly seeks to imply to the readers that they are being 'permitted' for their association with employment and its linkage with electoral politics. This is evident in the way, for instance, an article discussing a Delhi government move to register r-rickshaws, uses the word 'claims' to imply some larger politics at work regarding the employment aspect of e-rickshaws: "*the Centre as well as Delhi government had regularized the vehicles after claims were made that many e-rickshaw drivers were being denied a livelihood…*" (The Times of India, 2015). The contrast from the policy-related discourse on cars alludes to a deep-lying class dynamic instituted by the automobile which is often manifested through the use of words in relation to regulation of e-rickshaws, such as the use of the word 'slap' in the title of this article reporting on regulatory enforcement on e-rickshaws "*Cops to seize e-rickshaws, slap charges*" (The Times of India, 2014).

5.4.3 Infrastructure

The discourse on infrastructure for electric mobility reflects the privileging of cars users' experiences within the imaginations of the infrastructure needed for attaining desired mobility futures. Charging infrastructure remains a significant preoccupation of the discourse, with a much smaller focus on battery swapping. 'Charging' is the fourth most frequently occurring keyword in the sample of articles (Figure 14), with 59 articles containing the terms "charging infrastructure", "charging station" or "charging stations". In contrast, only eight articles refer to battery swapping, a technological alternative to public charging infrastructure that largely benefits e2Ws and e3Ws but is not considered a viable support system for e-cars. This indicates

a clear normative orientation of the discourse towards discussing the infrastructure requirements of e-cars.

At the heart of this normative orientation is the idea that public charging infrastructure provision is crucial to the electrification of passenger mobility. This is evident in the way most discussions on charging infrastructure proceed by prefacing that connection, such as in the opening sentences of an article reporting on the creation of additional public charging stations in the state of Kerala: "T*o help usher in an e-revolution on roads in the State, the government has decided to establish electric-vehicle charging stations in cities and major towns*" (The Hindu, 2020). The discussion here again, however, is mostly on automobiles, while the infrastructural needs of other modes such as e-rickshaws and electric 2Ws are largely overlooked. In the 59 articles that discuss charging infrastructure, 16 discuss it exclusively or predominantly in the context of cars against only 3 each for e-rickshaws and e2Ws. While 8 articles discuss dedicated charging infrastructure for e-buses, they do so typically within the context of acquisition of e-buses by public bus agencies, and not whether growth of e-buses is, or is not, contingent on suitable provision of charging infrastructure.

Further, within the 29 articles that discuss charging infrastructure in the context of no specific mode or multiple modes, the discourse often foregrounds 'motorists' as the primary beneficiary of infrastructure, such as in the following opening sentences of an article reporting on charging infrastructure development in the state of Karnataka: *"As part of its overarching plan to boost eco-friendly modes of transportation, Chamundeshwari Electricity Supply Corporation (Cesc), Mysuru has decided to set up eight stations where motorists can charge their electric vehicles along the Bengaluru highway"* (The Times of India, 2019b). This is also evident in the imagined geography of the public charging infrastructure in the way shopping malls, high-end hotels, movie theatres and multiplexes, housing societies, restaurants and cafes, restaurants, tech-parks, and gyms are foregrounded in the discussions on charging infrastructure provision (The

Times of India, 2018a). Class connotations are also discursively deployed to indirectly signal the car user as the intended end-user of charging infrastructure. For instance, in an article reporting on a car rental company inducting e-cars into its fleet, the following quote from the Managing Director of the company is included without any qualification as to what 'prime location' means, which subtly reinforces the notion of upper-class car users as the primary beneficiary of charging infrastructure:

> *"The tie up with Mahindra Reva*[9] *also enhances the electric vehicle charging infrastructure in India with over 100 re-charge points at* ***prime locations*** *in Mumbai, Delhi and Bengaluru…"* [emphasis added] (The Times of India, 2013).

In contrast, within the context of e-rickshaws, the attention is directed towards concerns over safety of charging practices of e-rickshaw drivers or of electricity theft, such as in the opening sentences of an article reporting on a court order to the Delhi government to set up charging stations: *"…Delhi government has been directed by a court here to prepare modalities to create legal recharging stations for e-rickshaws to stop electricity theft in the national Capital"* (The Hindu, 2016).

5.4.4 Subjectivities

The representation of different voices in the discourse offers insights about the imagined subjects of transition. Only the voices of automobile users are directly represented in the form of consumers (see later) while the lived experiences of non-automobile users, like those of e-buses and e-rickshaws rarely make it to the articles. Indeed, for e-rickshaws, insofar as voices are represented, they are of rickshaw drivers rather than passengers, which remains consistent with e-rickshaws being seen as a mode of employment rather than an integral part of the transition. For instance, note how in an article talking about a crackdown by the authorities on

[9] Reva was India's first indigenously developed e-car, which was acquired by Mahindra & Mahindra, one of India's largest automobile firms, in 2010.

illegal e-rickshaws, the sole voice represented is of a driver, with no attention paid to the fate of users who may be depending on e-rickshaws for their mobility: "*E-rickshaw driver Saroj Singh said his vehicle was better than mini city buses and autorickshaws which emitted black smoke. "If the department seizes our e-rickshaws, we will be unemployed. I bought this vehicle after selling two rickshaws…*" (The Times of India, 2018b).

The analysis indicates that the transition is discursively imagined as a multi-actor process centred around existing automobile users as the critical agent of the transition. This automobile subject is imagined as a generic middle class aspirational consumer whose wants are to be encouraged and facilitated by other subjects engaged in the provision and governance of automobility and denoted through words like 'players' and 'government incentives'. For instance, see the following text from an opinion piece about the barriers to electric mobility in India: "*…for India to switch to EVs and hybrid vehicles faster, players will have to work on one mantra that drives Indian customers when it comes to automobiles - mileage"* (The Indian Express, 2018a). Similarly, see how the insertion of a quote from an official from Maruti Suzuki – a household name in India with a market share as high as 50% for passenger vehicles – in an article discussing the need for incentives for e-mobility transition narrows down the imagination of desired future of sustainable mobility to e-cars:

> *"Underlining that affordability will hold key to the success of electric vehicles (EVs) in India, Maruti Suzuki India chairman* [name omitted] *said that some government incentive would be required to make such vehicles affordable, as the country moves towards the eco-friendly solution for mobility"* (The Indian Express, 2017).

In both quotations, the prevailing subjectification limits the imagined electric mobility futures to one-on-one replacement of fossil fuel by electric cars. In this manner alternative futures, such as expansion of e-rickshaws reducing uptake of 2Ws or even cars and/or functioning as efficient feeder mode for mass transit systems in cities, are backgrounded.

5.5 Discussion and Conclusions

Using the concept of sociotechnical imaginaries, this study has investigated different potential mobility futures attainable through electrification, reflected in the priority accorded to electrification of different modes, that are legitimized or delegitimized by the news media discourse, and how these processes of legitimization and delegitimization are linked to the politics of passenger mobility. Informed by Critical Discourse Analysis principles, this paper has analysed 275 articles on electric mobility from three of India's most widely circulated English-language newspapers between the period of April 2009 and August 2020.

From the discourse analysis, two contrasting sociotechnical imaginaries emerge in respect of electrification of passenger mobility system in India, one of 'environmentally friendly automobility' and another of 'electrification of rickshaws for employment'.

The first imaginary is a vision of a desired mobility future centred around unfettered growth of cars that is supportive of, and supported by, electrification through removal of constraints on the growth of automobility like air pollution and CO_2 emissions. This imaginary is rooted in deeply normative societal ideas about cars being not just the ultimately preferred means of mobility, but also as the quintessential symbol of success and high socioeconomic status in a modern urban India (Butcher, 2019, Edensor, 2004, Nielsen and Wilhite, 2015). The discourse evidences a performative element to these normative ideas, such as in the form of equating the national level EV transition with e-cars, the valorisation of e-car users as environmentally conscious citizens, and the foregrounding of charging infrastructure needs of e-car users. Finally, these normative ideas pervade the discourse across the four dimensions: modes, policies, infrastructure, and subjectivities.

Across these four dimensions, e-cars are discursively positioned as unique in comparison to e-rickshaws, e-buses, and e-2Ws. This is evident from the balanced coverage of e-cars across different categories of news articles, attention to their system-wide transition dynamics,

exclusive linking of e-cars with India's electrification targets and ambitions, and the foregrounding of e-cars as the solution to issues of air pollution and climate change. Policy-related discourse also by and large reduces the need for policy support for electrification to subsidies for unfettered growth of e-cars. The discourse plays up the need for public charging infrastructure as crucial for the shift towards e-cars and marginalizes the infrastructure needs of other modes or technological alternatives like battery swapping that do not benefit e-cars as much as e3Ws and e2Ws. Finally, the discursive construction of automobile users as the imagined principal agents of the transition is another manifestation of this imaginary underpinning the discourse.

The second imaginary of 'electrification of rickshaws for employment' is a vision of a desired mobility future where unfettered growth of e-rickshaws is not permitted (in contrast to e-cars) and this mode of transport is rather imagined as a source of employment. In contrast to cars, this imaginary is rooted in deeply normative ideas around e-rickshaws being an undesired presence on the street, which may reflect different sentiments. The undesirability of e-rickshaws may, for instance, be associated to the lower socioeconomic status of their typical users. It may also reflect some deep-rooted discomfort among well-educated, (upper) middle-class strata in contemporary India about an erstwhile non-motorized and "backward" mode (cycle rickshaw) becoming "motorized." At play here may be subconscious notions around the speeds at which people from different socioeconomic status are 'entitled' to move at on the road. These issues warrant further attention in future research but do suggest that the (re)production of STIs around e-mobility in India is grounded in, and reinforcing, class politics.

As with the first imaginary, one finds a degree of performativity around a normative future where e-rickshaws are primarily viewed as a source of employment and their growth is regulated. The performative element shines through in the way that the discourse highlights the employment aspect of e-rickshaws while downplaying their potential role within the passenger mobility

system, foregrounds their aspects of legality, views their charging infrastructure needs from the lens of safety and electricity theft, and voices the opinions of e-rickshaw drivers rather than users.

While this study has identified two sociotechnical imaginaries, a normative vision around e-buses as a panacea for urban air pollution issues was not classified as an STI. This reflected that the analysis did not reveal a significant degree of performativity around the normative aspect of this vision (the idea of a desired pollution-free future), and certainly not along all the four dimensions considered in this study. To an extent, this might be an issue of scale of analysis in this study, which is a relevant factor to the construction and circulation of sociotechnical imaginaries as Mutter (2019) has pointed out. At the same time, it is important to consider that this study only engaged with English news coverage at the national level. This vision around e-buses may have normative and performative dimensions rooted in local urban politics. This could be detected through a detailed examination of a news coverage at urban/ state levels and in particular, the coverage in regional language newspapers.

This study's main theoretical contribution is to demonstrate how the politics of mobility transitions in emerging economies is likely to be multi-dimensional, with one of the dimensions, namely contestations between priority for electrification of different modes, being explored in this paper. Within the sociotechnical transitions scholarship, this would constitute the politics of whole system transitions whereby a whole system transition (Geels, 2018, Geels and Turnheim, 2022) may potentially reconfigure pre-existing competing interests between adjacent sociotechnical systems within the whole system, creating conflicts or contestations that are different to and beyond the niche-regime dynamics that the transition politics literature has largely focused on. This study shows how the two imaginaries allow electrification to reinforce the entrenchment of automobility at the expense of other transport modes, whereby the transition to electric mobility is assimilated into the prevailing politics of passenger mobility

systems in India. This dynamic is likely to exist across much of the emerging economies where passenger mobility systems comprising a wide range of modes are undergoing electrification currently and further studies to examine them is recommended. In this vein, Schmid et al. (2021) identify gaps in the transition politics scholarship concerning the politics of mobility transitions as well as transitions in emerging economies. This study seeks to address both of these gaps.

This study's findings also have implications for the policies and governance of electric mobility in India. It is clear that the imaginaries in the news discourse remain divorced from both the ground realities of electrification, where electrification of cars is happening at a slower rate than all other modes, as well as national policy priorities for electrification of buses, 2Ws and 3Ws. In a way, this is indeed the point of the imaginaries, i.e., to performatively put forth normative visions around electrification. Yet, contestations between policy visions and sociotechnical imaginaries constructed within a space like mass media can undermine the efficacy of the policies. This possibility of contestations speaks to the need for societal embedding of electrification in India and driving changes in user practices and meanings.

Finally, this study has focused on the period up to 2020 as it was assumed that the COVID-19 pandemic disrupted the natural patterns of news reporting regarding e-mobility in India. However, it is unlikely that the findings of this study would stand to be substantially at variance with the discourse on electrification post-COVID. Cursory engagement with the news coverage of electric mobility since 2021 indicate that the quantum of reporting on e-buses and e2Ws is likely to have increased, in line with increased policy attention on those two modes in recent years. However, it remains unlikely that the imaginations of electrification have changed, as they are rooted in deeper normative ideas around desired forms of mobility. Considering electrification as a pathway to shake up these deeply rooted ideas may be hopeful at best, particularly when electric mobility is intricately tied to India's political economy ambitions of

becoming a global leader in manufacturing of electric cars (Department of Heavy Industry, 2012).

CHAPTER SIX: NOT JUST A FUEL CHANGE: EXAMINING ELECTRIFICATION AND THE SHIFTING POLITICS OF URBAN BUS SYSTEMS IN INDIA.

Abstract

Urban bus systems in India are presently in a state of transition to electric buses. Extant literature on this topic has not examined if and how electrification has changed the politics of urban bus systems. More generally, transition politics literature also has mostly focused on the politics of system change, rather than how system change can shift the inherent politics of a sociotechnical (ST) system. This paper seeks to address these two gaps. Building on sociotechnical transitions theory and the multi-level-perspective framework, it argues that changes in the politics of a system can be examined through changes in the rules that constitute the ST regime. It posits that rules are key to the process by which tradeoffs between competing interests related to ST system are resolved, i.e., the politics of the ST system. Building on this theoretical framework, this paper examines changes in four dimensions of urban bus systems in India: operational & financial efficiency, funding, infrastructure, and service levels. The study finds multiple changes in rules occurring within each dimension that account for shifts in the way trade-offs are resolved within those dimensions. There is clear evidence of shifts occurring in the politics in ways that are likely to improve urban bus systems and make them more efficient. However, caution is advised against potential unintended consequences of the shifting politics for urban mobility and environment.

Keywords: electric mobility, bus systems, politics, India, sociotechnical regime

6.1 Introduction

Alongside electrification of motorised transport modes, a modal shift towards public transport use is expected to play a key role in the realization of global decarbonization targets for transportation, particularly in emerging economies like India (IPCC, 2018, 2022). Buses are a crucial part of public transport systems in Indian cities. Almost 62% of the population in urban areas rely on buses for some form of mobility (NSSO, 2016: p. 8). Buses are also usually the cheaper means of mobility: a journey in a rail-based transit can cost up to 3 times that in a bus (Patel et al., 2019: p. 23). They can adapt to changing spatial patterns of travel demand and can provide a denser coverage of public transport than rail-based systems (Roychowdhury, 2023). Yet, despite their significance, they often suffer from issues such as operational and financial inefficiencies, low service levels, poor upkeep, lack of funding, and inadequate infrastructure support (Dash, 2022, Deshmukh et al., 2022, Roychowdhury et al., 2017).

To address some of the identified issues, urban bus systems in India have witnessed various large-scale changes, such as the integration of intelligent transport system (ITS) technologies with bus operations (e.g., Ghosh and Schot, 2019), augmentation of fleet supply in cities under the JnNURM (Jawaharlal Nehru National Urban Renewal Mission) between 2009 and 2013 (Swamy and Sinha, 2014), a shift from public-run to public-private-partnership (PPP) model of operations and maintenance (Ahmad et al., 2020), accordance of physical priority on roads via the bus-rapid-transit (BRT) model (Kathuria et al., 2016), and the fuel switch from diesel to CNG (compressed natural gas) (e.g., Krelling and Badami, 2022).

Electrification marks the latest large-scale system-wide change within India's urban bus sector. It took off after fully battery-electric buses became eligible for government subsidy in 2017 under an ongoing national government policy. Urban buses in India largely run on diesel and to a lesser extent on CNG. Electrification makes buses emission free at the tailpipe, helping to address issues of local air pollution as well as global warming if combined with cleaner

production of electricity. This logic has driven a concerted focus on electrification of buses under various national policies and schemes.

Scholarly attention to this ongoing transition in India has largely been within techno-economic traditions of research where the focus is on the technical and technological aspects of the transition, such as charging infrastructure deployment and route planning (Gairola and Nezamuddin, 2022, 2023), quantification of reduction in emissions (Bhat and Farzaneh, 2022) and estimation of impacts on the power grid (Rodrigues et al., 2020). This is hugely valuable given the wide range of operational changes that bus systems will need to go through during the e-mobility transition. However, extant scholarship has not yet attended to the extent and manner in which electrification may trigger changes to the politics of urban bus systems in India.

Urban bus systems are political at two levels. They are a part of urban mobility whole systems (Geels, 2018) comprising multiple modes (e.g., car, bus, metro, cycle, etc.), all of which are striving for priority (see Gopakumar, 2020), sustenance or at times even survival, and often represent competing interests at the urban mobility whole system level. In addition, at the level of the bus system itself, there are multiple interests represented by various actor groups such as users, operators, national government or bus manufacturers, which can often be at odds or outright competing with each other (Figure 17). In the current context, then, politics can be understood as the process through which tradeoffs between these competing interests are resolved within a context of limited resources (DeSombre, 2020: p. 24). ‘Resolved’ here does not imply a permanent or even long-term resolution, but rather a semi-permanent fix which is subject to constant negotiation and possibly frequent change.

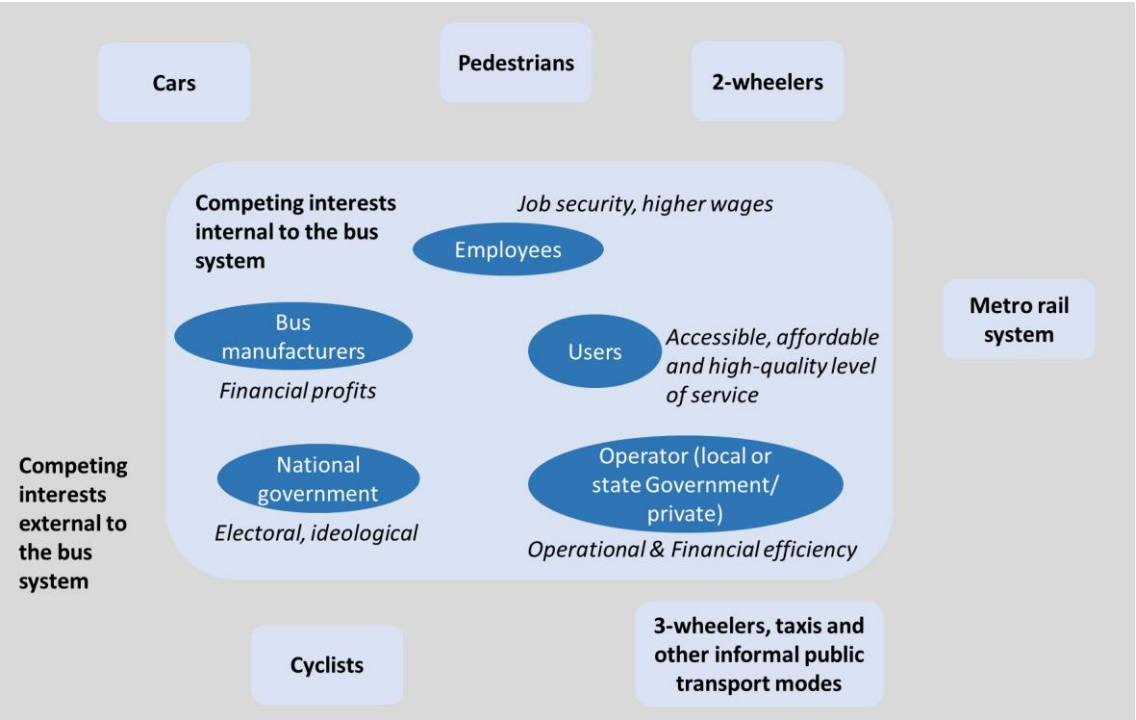

Figure 17: Schematic depiction of competing interests and interest groups for a bus system both within the system and at the whole system level

A system change, such as electrification, will involve the politics of bus systems at both levels, and has the potential to alter it. Electrification can trigger changes at the whole system level whereby the process of affording priority to bus systems by various actors (see Figure 17) against other modes can be altered. It can also change the process through which tradeoffs between competing interests within the bus system are resolved by various actors and actor groups representing those interests. Building on the premise of a bi-level politics, this paper seeks to investigate what changes in politics electrification of buses is triggering and how. In doing so, it intends to contribute to the transition politics literature that has expanded over the past 15 years in response to early criticisms about lack of attention to politics (Meadowcroft, 2011) in sociotechnical transitions (STT) scholarship.

However, it diverges from the mainstream transition politics literature that typically focuses on the politics of change itself, such as the resistance strategies of various actor groups to sociotechnical transitions (e.g., Geels, 2014). Instead, it examines how a process of system

change can shift the inherent politics of the system itself. Furthermore, within the ST transitions scholarship on mobility, issues of politics have so far largely, though not exclusively, been studied for transitions of the automobility regime (e.g., Martin, 2021). This is a function of the geographical focus and origins of transition literature in Western Europe where automobility remains the dominant, albeit contested, regime. There is a need to expand scholarly attention to alternative mobility regimes in non-Western geographies, such as rickshaws (e.g., Dutt, 2022a) or buses and their shifting politics, which, as Schmid et al. (2021) point out, remains a gap in transition politics literature. Addressing this gap, the key contribution of the current paper is to examine the change in politics of urban bus systems undergoing electrification in India.

The next section draws upon sociotechnical transitions scholarship to provide a theoretical framework for the study. Section 6.3 offers an overview of the ongoing transition to electric buses in India. Section 6.4 discusses the analytical approach, case studies, data and methodology used for the empirical analysis. Section 6.5 presents the results, while Section 6.6 discusses the study's findings and its implications. Section 6.7 presents some conclusions from the study.

6.2 Theoretical framework

Extant literature on the politics of urban bus systems in India is scant. Given the key role that bus systems play in the mobility of low-income classes, a recurring theme of existing scholarship is to explore how class politics in Indian cities plays out within bus systems. For example, using the case study of the city bus system in Bengaluru, Joseph and Gopakumar (2023) have examined how the publicness of the bus system is shaped by the intersection of the 'macro-politics' of scheduling and fare collection with the 'micro-politics' of users' adaptability and resistance. Their understanding of politics is, however, different from what I have adopted in this study.

Scholarly attention in particular to the politics of system change in bus systems is often reserved to examination of the success or failure of the change itself, with a particular focus on multiple bus rapid transit (BRT) projects that were implemented across Indian cities during the past two decades (e.g., Oommen and Sequeira, 2021). While it is important to understand the political nature of system change in terms of success and failure or resistance, current literature has not examined how system change can trigger changes in the politics of bus systems themselves. To an extent, this also holds true for the wider sociotechnical transitions literature (see later in this section), within which this study situates itself, given the sociotechnical nature of change being studied in this paper, i.e., electrification.

A sociotechnical system, such as an urban bus system, is a configuration of elements including technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge that work together to perform important societal functions like passenger transportation (Geels, 2004). This configuration is kept stable by the actions of various actor groups, including but not limited to, engineers, policy makers, users, and civil society organisation. These groups' actions are stabilised, legitimize and routinised through a sociotechnical 'regime', a set of regulatory, normative, and cognitive rules (Geels, 2002, Fuenfschilling and Truffer, 2014). *Regulative rules*, such as emission regulations, refer to the explicit formal rules that constrain behaviour and regulate interactions. *Normative rules* includer values, norms, rights, duties, and expectations and are internalized through socialization processes (e.g., cultural values in society). *Cognitive rules* refer to the frames through which one makes sense of their reality (e.g., symbolic meanings of technologies, user practices and preferences).

A regime is characterized by alignment of these sets of rules across the aforementioned elements of a sociotechnical system, which helps to further stabilise the system. In contrast, 'niches', protective spaces created around nascent innovations to allow them to develop (Smith

and Raven, 2012), do not have the level of rule alignment that characterises regimes. The rules associated with niche-innovations are characterized by greater instability, fragility and instability. Within the classical multi-level-perspective (MLP) framework, cognitive, regulative, and normative rules around the ST innovation mature and align to a degree that the niche-innovation is able to challenge, disrupt and eventually displace or durably reconfigure the regime. This often happens when the niche-innovation is able to take advantage of pressures on the regime from the 'landscape', a combination of wider contexts and developments over which regime actors have little influence, such as demographic shifts, economic crises, and climate change (Geels, 2005b).

The urban bus regime in India is multi-scalar, partly by virtue of urban transport being a concurrent subject under the Indian constitution, with both the Central and state/municipal governments having power and control over different aspects of urban transportation. The operations and maintenance (O&M) of buses are typically managed by State Transport Undertakings (STUs), government agencies in charge of bus-based public transport system that report to either the State or municipal government (depending upon whether devolution of powers has happened in the state). However, rules, regulations and standards are set under the Motor Vehicles Act of the central government. Furthermore, the central government also, and crucially, maintains a financial lever, whereby it uses various types of grants to impact and shape urban governance and infrastructure provision, including public transportation. Thus, the urban bus system is shaped by the actors, institutions, and policies at the national, state and city levels.

Past studies have highlighted a lack of in-depth analysis of the sociotechnical regime (Ghosh and Schot, 2019), although attention to this theme has grown over the years (e.g., Dzebo and Nykvist, 2017, Hirt et al., 2021). An adjacent gap in scholarship that has not been highlighted or attended to is the connection between regime rules and the (changing) politics of ST systems.

This resonates with Kok's (2023) contention that the MLP literature has, in comparison to agency, paid significantly less explicit attention to how structure (and its various interpretations including but not limited to regime rules) is linked to the politics of transitions. This study argues that rules are key to the process by which various tradeoffs between competing interests are resolved (see below). Therefore, an examination of changes in rules within the context of a ST transition can lend insights into changes in the processes by which tradeoffs are made and offer a basis for understanding the changing politics of the ST system.

This study argues that the connection between rules and tradeoffs plays out in three ways. In the first instance, some tradeoffs are made directly by regime actors who may be guided by one or more rules, modify them through their actions, and/or even create new ones while undertaking action. For example, officials in an STU may opt against a PPP model of bus operations, despite the potential of higher efficiency and/or service levels, because they prefer to protect some of their employees that could be laid off in the wake of privatization. This action could be guided by a cognitive rule concerning attitude towards PPP, or a normative rule concerning ideological positions with respect to privatization.

In the second way, tradeoffs between competing interests are indirectly linked to the action of regime actors. For example, decisions about funding for the purchase of new buses in a city involve trade-offs between whether or not to improve the bus system. In this case, less funding for buses may not directly imply higher funding for other modes. However, an inadequate number of buses to meet growing travel demand may lead to increased ownership of 2Ws that may in time increase road congestion and precipitate expenditures on road expansion. Here, a competing interest is served in an indirect way. The decision regarding bus funding, therefore, is a political action by actors who could be guided by cognitive rules concerning routine practice for deciding the level of funds to be spent every year on purchasing buses. Alternatively, the actors could also be guided by, or indeed rework or create a normative rule that accords priority

to public transport in the city for addressing climate change. They may, therefore, allocate more funding than is usually done under routine practice.

The third way in which trade-offs may be resolved is without any explicit action whereby socio-material realities of the system reinforce certain rules that serve particular set of interests. For instance, oligopolistic market control by a small number of bus manufacturers may create a cognitive rule regarding understandings of who can manufacture buses, thus constraining the entry of new companies. Here, the tradeoff between the competing interests of profit for the bus manufacturer and cost efficiency for the government operator may be resolved through the cognitive rule rooted in socio-material realities.

In any of the three situations described above, the emphasis on rules is not to imply a structuralist account of politics. Under the first two ways, agency would account for the ability of actors to choose from amongst different (types of) rules available to them for legitimizing their action or to create a new rule through the process of making the tradeoff (this is not to imply that all actors will have the equal ability to make choices – agency is likely to be unevenly distributed within the system). Indeed, the MLP also conceptualizes structure and agency in this manner, building on Giddens' "duality of structure" (1984), whereby regime rules are considered both medium and outcome of action (Geels, 2004, Geels, 2011). To extend the example used earlier, a bureaucrat or a minister would still need to exercise their agency to choose between a cognitive rule concerning routine practice and a normative rule that accords priority to public transport when deciding the amount of funds to be allocated for bus system expansion. Furthermore, they may create a normative rule through use of their agency to allocate larger than routine funding on grounds that it would help address climate change. Under the third way, cognitive rules would still be reproduced through the actions of regime actors, such as tenders for supply of buses that may rule out small-scale or new bus manufacturers through their eligibility criteria on grounds of inadequate prior experience of meeting large-scale supply.

By connecting the concept of regime rules to the politics of ST systems, this paper aims to make two contributions. Firstly, it seeks to address gaps in transition politics literature regarding the lack of attention to linkages between structure and politics (Kok, 2023). Secondly, this paper seeks to conceptually add to extant transition politics literature that has largely focused on the politics of system change (for instance, how various interests and regulations can help keep the regime dominant or otherwise, e.g., Ford and Newell, 2021, Geels, 2014, Kungl, 2015), but not paid adequate attention to how system change affects the inherent politics of systems. By 'inherent' politics, I refer to the configuration of interests over and beyond those enabling or resisting system change specifically, and where the process of making trade-offs between competing interests predates and exists independently of system change. For instance, contestations between various actor groups (national government, state government, private bus operators, etc.) surrounding increased involvement of the private sector in the operations and maintenance of urban buses in India predate the transition to e-buses (see Parashar and Dubey, 2011). Actor groups' dispositions towards transition to e-buses, if relevant at all, may not be linked to their dispositions towards privatisation of urban bus systems. Yet, electrification may trigger substantial shifts in the dynamics surrounding the privatization of urban bus systems (see later). This paper employs a case study of electrification of urban bus systems in India to make this contribution. The next section provides a brief overview of the ongoing transition to e-buses in India.

6.3 Electrification of urban bus systems in India – a brief overview

Electrification of urban bus systems in India took off in 2017 after e-buses became eligible for subsidy under the then running FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) Phase I scheme (Singh et al., 2022). FAME I was the first national-level scheme launched in 2015 with a total outlay of USD 130 million (INR 895 crores) to promote adoption of EVs in India through, amongst other things, provision of end-user subsidy (Press Information

Bureau, 2022). 465 e-buses were sanctioned across 10 cities under FAME I which ended in 2019 (Press Information Bureau, 2019a).

After the termination of FAME I, the FAME Phase II scheme was launched in 2019 with a much higher scale and ambition: a total outlay of USD 1.3 billion (INR 10,000 crore) (Department of Heavy Industry, 2019). 35% of this outlay was earmarked for the purchase of 7,000 e-buses (ibid.). A significant change between the FAME I and FAME II schemes was the mandate in FAME II for STUs to procure e-buses on a gross-cost public-private-partnership (PPP) model, where a private operator buys, operates, and maintains the buses as per standards set out by the STU who in turn pays the private operator on a per operated kilometre basis (UITP, 2020). During the first phase of FAME II in 2019-2021, approximately 3,500 e-buses were sanctioned across 32 cities (CESL, 2022).

Following this, due to variations in costs quoted by private operators in different cities for similar operational standards, Niti Aayog (Government of India's public policy thinktank) tasked a central government agency, CESL (Convergence Energy Services Limited), to standardize and aggregate the demand from various cities for e-buses and issue a joint tender for the second and final trench of e-buses to be purchased under FAME II (ibid.). The idea was to achieve uniform and lower prices with OEMs receiving bulk orders that would combine the requirements of several cities. 5,450 e-buses (more than the total number of buses eligible for the remaining FAME II subsidy) were procured under this scheme called the Grand Challenge (ibid.).

In 2022, the Government of India announced the National Electric Bus Program (NEBP) that targets a sale of 50,000 e-buses over 5 years (ibid.). Following this, in August 2023, Government of India announced the launch of 'PM-eBus Sewa' scheme whereby the national government will provide financial support to the tune of USD 2.6 billion (INR 20,000 crores) towards procurement of 10,000 e-buses on a PPP model in 169 cities (PIB, 2023). This scheme effectively provides financial backing to the NEBP.

6.4 Research Design

6.4.1 Analytical approach

The empirical study examines changes in various rules within four dimensions of the bus system where electrification is triggering changes: operational and financial efficiency, funding, infrastructure, and service levels. These dimensions are premised on some of the major issues[10] linked to the politics of bus systems that have been highlighted in literature (Table 9). While there are rules in other dimensions that are likely to change through the transition too (e.g., regulative, and cognitive rules concerning financing of bus purchase), they are not associated with tradeoffs in any real sense but rather represent the expected re-alignment of rules during the process of a regime change, and therefore, have not been considered for empirical examination.

6.4.2 City-level case studies

As mentioned earlier, the urban bus regime in India is multi-scalar. For the purposes of this paper, therefore, electrification of the urban bus system is considered at the national (see Section 6.2) and the city levels, with three city bus systems considered for the empirical analysis. Although drawing specific city-level inferences is not the aim of this paper, examination of electrification of India's urban bus system will be incomplete without examining the role of the national and state governments as well as the cities and the STUs where electrification is effectively happening. A brief discussion on the city-level case studies follows.

The study considers three cities alongside the national level for the empirical analysis: Delhi, Mumbai, and Bengaluru. Together, they cover the three types of governance contexts within

[10] While a fifth issue of accessibility (in terms of spatial coverage, frequency of service, physical accessibility and affordability (Behal, 2020, Patel et al., 2019)) is also important, it was not found to have strong linkages with electrification and was dropped from the analysis after initial consideration. For example, electrification is not affecting the spatial coverage of bus systems or the process by which tradeoffs are made in that regard. Where applicable, issues of accessibility have been examined within the other four dimensions.

which STUs find themselves in India, and also represent varying degrees of electrification, differences in the efficiency and service level of buses, and different O&M models (Table 10). This diversity is useful to capture how electrification is (or is not) changing the politics of bus systems within different contexts within India.

Table 9: Types of rules and dimensions of bus systems examined in this study

Dimension of urban bus system	Issues linked to the dimension	Regulative rules related to the dimension	Cognitive rules related to the dimension	Normative rules related to the dimension
Operational and financial efficiency	Operational and financial inefficiencies (Roychowdhury et al., 2017, WRI, 2021)	Policy stipulations regarding specific O&M models (e.g., public-private-partnership)	Norms held by different sets of actors around who can and should operate and maintain buses	Ideological issues associated with different O&M models (e.g., pro, or anti-privatization)
Funding	Inadequate funding for fleet expansion (DIMTS, 2016, HPEC, 2011)	Policies and schemes for funding of buses	Routine practices for funding allocation	Political support for funding bus systems
Infrastructure	Lack of adequate and requisite infrastructure (Deshmukh et al., 2022, Kharola, 2013)	Policy stipulations for creating requisite infrastructure	Routine practices around infrastructure creation	Political support for infrastructure creation
Service levels	Poor quality of service (Li, 2011, Suman et al., 2016),	Contractual or binding service targets	Norms held by different sets of actors around what level of service is achievable and how User expectations of level of service	

Delhi is the only city-State in India's federal system where an elected state government, the Government of National Capital Territory of Delhi (GNCTD), rules over what is effectively a city (97% of Delhi's area is urban). Buses in Delhi are operated both by a public agency, Delhi Transport Corporation (DTC), and on a PPP model by an agency called Delhi Integrated Multimodal Transit System (DIMTS). Both the DTC and DIMTS report to the GNCTD's Department of Transport. Delhi's bus system, while crucial to the city, has suffered from neglect in comparison to its rail counterpart, Delhi Metro, which continues to draw in significant investments for its expansion and operations. With an operational fleet of 1,300 e-buses (17% of the total fleet) as of December 2023 Delhi has the highest number of e-buses running in any city in India (PTI, 2023).

Mumbai is one of the few big cities in India where the government is devolved such that the two public agencies in charge of the city's bus services, Brihanmumbai Electric and State Transport (BEST) Undertaking and Navi Mumbai Municipal Transportation (NMMT), report to the respective municipal corporations that govern different parts of Mumbai. Both the NMMT and BEST have engaged in a PPP model of bus operations at different times. Bus services in Mumbai play a secondary, though important, role to the suburban rail system that serves as the lifeline for the city's commuting needs. Mumbai was the first city in India to operate e-buses and presently has a growing fleet that comprises a total of 644 e-buses (17% of total fleet) operated by BEST and NMMT.

Finally, Bengaluru represents the rather standard case of a non-devolved urban governance system in India where the public agency in charge of bus system, Bangalore Metropolitan Transport Corporation (BMTC), reports directly to the State government. Bengaluru's bus system, operated directly by BMTC until recently, has long been revered as arguably the best and most efficiently run urban bus service in the country and commands a dominating

presence in the city. Bengaluru has relatively modest state of its fleet electrification with 390 e-buses (6% of total fleet) presently operational.

Table 10: Case study descriptions

City	STU(s)/ agencies operating bus services in the city	Model of operations	Efficiency levels and role of bus system in addressing city's commuting needs	Degree of electrification (e-buses/ total fleet)	STU's governance system
Delhi	DTC/ DIMTS	Public-run/ PPP	Low/ Crucial	1300/7400	Under a city-state government
Mumbai	BEST	Public-run/ PPP	Low to medium/ Secondary to suburban rail system	464/3328	Under a devolved municipal administration
	NMMT	Public-run/ PPP	Low-to-medium/ Crucial	180/450	Under a devolved municipal administration
Bengaluru	BMTC	Public-only until induction of e-buses	High/ Very significant	390/ 6767	Under the State Government

6.4.3 Data and methods

The empirical analysis relies on semi-structured interviews, print news archives and data from a range of secondary sources. For examining changes in cognitive rules, a wide range of actors belonging to the urban bus regime were interviewed. This included heads of operations & maintenance and depot managers of various STUs, CEOs, Chief Technology Officers, and senior officials of private bus operators and bus manufacturers, as well as experts working on bus operations and e-bus transition within the non-profit and consulting sector. A total of 20

interviews were conducted as shown in Table 11. The names and positions of interviewees are not included in the table to protect their anonymity. Where direct quotes have been used in the paper, the exact affiliation has been withheld to minimize the probability that readers might attribute the opinion or view to the interviewee's organization.

The interviewees were considered best placed to reveal changes in the regime actors' understandings of 'how things work', i.e., cognitive rules such as industry practices, problem-defining and solving approaches, etc. To understand changes in regulative rules and normative rules, various types of secondary data were used. These included national and various state government policies, schemes, regulations, and press releases in respect of e-buses, data on various parameters of physical and financial performance of STUs, and archived news articles. These pieces of data were collected through internet search based on the principles of purposive sampling as it was needed to collect specific evidence on changes being observed in specific rules. Different search terms were employed related to the rule under consideration to find documents that would contain evidence regarding the rule. For instance, government documents were looked up where specific regulative rules were likely to be found, such as guidelines issued by the Government of India for operationalizing electric buses under the FAME scheme in cities on a public private partnership model. Similarly, various non-governmental agency reports were looked up to search for specific data, such as the list of bus manufacturers that supplied buses to cities under the FAME scheme. News articles were also searched for reporting on specific developments or issues, such as lack of parking for buses or purchase of e-buses in the case study cities. A summary of key pieces of secondary data used in this paper is provided in Table 12. Interviews were also used to examine changes in regulative rules where certain policies and regulations were not publicly available, and normative rules, such as political support that could not be otherwise gauged from publicly available information or without conducting extensive surveys that were outside the scope of this study.

Table 11: List of interviewees

Interviewee code	Type of organization	Number of officials interviewed	Geographical unit/ scale of interviewees
STU1 – STU9	STU	9	City
BM1 & BM2	Bus manufacturer	2	National
O1	Private bus operator	1	National
T1 – T4	Thinktank	4	National
IC1 & IC2	Independent Consultant	2	National

Table 12: Summary of key pieces of secondary data used for analysis

Type of data	Data sub-type	Title of data	Institution (year)	Document code	Bibliographic reference
Government document	Report	Public Private Partnership in Operation and Maintenance of Electric Buses in Cities (OPEX Model): Model Concession Agreement	Niti Aayog (2019)	DOC1	Niti Aayog (2019)
	Official notification	Guidelines for financing purchase of buses and ancillary infrastructure for urban transport systems under Jawaharlal Nehru National Urban Renewal Mission *(JnNURM)*	Ministry of Urban Development (2013)	DOC2	MOUD (Ministry of Urban Development) (2013)
		Publication of notification in Gazette of India (Extraordinary) regarding Phase-II of FAME India Scheme	Department of Heavy Industry (2019)	DOC3	Department of Heavy Industry (2019)
		Request for Proposal (RFP) for operation of stage carriage	BEST Undertaking (2021)	DOC4	BEST Undertaking (2021)

		services for public transport of 200 double decker AC electric buses with driver in the city of Mumbai & its extended suburbs on Gross Cost Contract (GCC) model for 12 years			
	Press release	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (Ministry of Heavy Industries) (2022)	Press Information Bureau (2022)	DOC5	Press Information Bureau (2022)
Non-governmental publication		Electric bus procurement under FAME II: lessons learnt and recommendations for Phase-II	UITP (2020)	DOC6	UITP (2020)
		The cost of urban commute: balancing affordability and sustainability of public transport	Centre for Science and Environment (2019)	DOC7	Patel et al. (2019)
		Procurement of Electric Buses: Insights from Total Cost of Ownership (TCO) Analysis	World Resources Institute (2021)	DOC8	Vijaykumar et al. (2021)
		The Grand Challenge' for Electric Bus Deployment: Outcomes and Lessons for the Future	Convergence Energy Services Limited (2022)	DOC9	CESL (Convergence Energy Services Limited) (2022)
		An analysis of e-bus procurement in India - models, challenges and way forward	Institute for Transport and Development Policy (2022)	DOC10	Pati (2022)

		Market analysis of heavy-duty vehicles in India for fiscal years 2019–20 and 2020–21	International Council on Clean Transportation (2021)	DOC11	Sathiamoorthy et al. (2021)
		Electric bus: towards zero-emission commuting	Centre for Science and Environment (2021)	DOC12	Roychowdhury and Roy (2021)
		State Transport Undertakings Profile & Performance 2019-20	Central Institute of Road Transport (2022)	DOC13	CIRT (Central Institute of Road Transport) (2022)
News reports/ Non-governmental press release		DTC's low-floor buses on a collision course with Tata Motors	The Pioneer (2015)	DOC14	Vishav (2015)
		Solaris and JBM Group established joint venture in India	Solaris (2016)	DOC15	Solaris (2016)
		Delhi tops in terms of electric buses after Arvind Kejriwal govt introduces 400 new buses on streets	Mint (2023)	DOC16	Livemint (2023)
		New DTC buses welcome, but no space to park them	The Times of India (2015)	DOC17	Banerjee (2015)
		In public transport boost, Delhi gets 400 new e-buses; flagged off by CM and L-G	The Indian Express (2023)	DOC18	Mani (2023)
Webpage		Auto components and systems	JBM Group (2024)	DOC19	JBM Group (2024)
		State Level Policies	Niti Aayog (2023)	DOC20	Niti Aayog (2023)
		DTC Bus Route and Fare Chart	Delhi Transport Department (2023)	DOC21	DTC (Delhi Transport Department) (2023)

Changes in rules were considered over the period of 2014 to 2021, with 2014 marking the year preceding the introduction of the FAME I scheme in 2015 and 2021 the year in which the field work was conducted. Furthermore, as a general principle, if a divergence in opinions regarding rule change occurred, the opinions of those interviewees who were more proximally linked to the matter were given greater weight (e.g., the opinion of a government official would be considered with regard to changing normative rules for politicians, if it diverged with the opinion of, say, an interviewee from a think tank).

Thematic analysis was employed for analysing various sets of data. Thematic analysis is a method for identifying, analysing and reporting patterns or themes within qualitative data (Braun and Clarke, 2006). This study employs one of the three main schools of thematic analysis, called coding reliability (Braun and Clarke, 2022). In this approach, a codebook or coding frame is created, and data is allocated to predetermined themes. These themes are established early on in the analytical process, either before or after becoming acquainted with the data. They frequently align with the questions guiding the data collection. For this study, each dimension of the bus system (operational and financial efficiency, funding, infrastructure, and service levels) was adopted as a theme, with three sub-themes of cognitive rules, regulative rules, and normative rules mapped against each theme. Data from the interviews and secondary sources was then coded against each sub-theme and theme using NVIVO Pro version 12.6.0. Through this process, deductions were made on changes occurring within the rules.

6.5 Results

This section discusses the changes in rules across the four dimensions and the potential reasons for those changes. The changes in rules can be read against the existing set of rules associated with the process of tradeoffs within different dimensions that are linked to various issues of the bus system (Table 13). Sub-sections 6.5.1 through 6.5.4 discuss the existing rules

as well as changes in these for the main domains of operational and financial efficiency, funding, infrastructure development and funding levels.

Table 13: Pre-and-post electrification set of rules associated with various trade-offs

Dimension	Sub-dimension (if applicable)	Rules: pre-electrification & post-electrification				Actor group associated with the rule	Tradeoff(s) associated with the rule	Issues impacted by tradeoff
		Type of rule	Pre-electrification rule	Post-electrification change in existing rule	Post-electrification new rule			
Operational and financial efficiency	Choice of O&M model - PPP vs. state-run	Cognitive	Attitude towards PPP	Favourable attitudes developing in most STUs	N.A.	STU	Operational & Financial efficiency vs Employee protection, Service levels vs. employee protection	Operational & Financial efficiency, service levels
		Regulative	N.A.	N.A.	PPP made the mandatory model to avail FAME II scheme incentives	STU, Central Government		
	Role of OEM in bus system	Cognitive	Understandings of what OEMs are meant to do or not do	Changing from OEM being just the vehicle supplier to supplier and operator	N.A.	STU	OEM profits vs financial efficiency of STU	Age of bus fleet, service levels, financial efficiency
	Bus industry structure	Cognitive	Understanding around who can or cannot manufacture buses	Changing with e-bus manufacturing not viewed anymore as an oligopoly of	N.A.	STU, OEMs	OEM profits (through oligopolistic control) vs financial efficiency	Financial efficiency

				legacy manufacturers			(through perfect competition)	
Funding		Cognitive	Routine practices for allocation of funds	N.A.	N.A.	STU/ State Government	To improve or not improve the bus system	Service levels
		Cognitive	Symbolic meaning of buses	Changing from 'necessary' to 'modern'	N.A.	STUs/ State Governments		
		Normative		N.A.	Priority for buses over private vehicles	Central Government		
		Regulative		N.A.	Schemes at state level for e-bus funding	State Government		
Infrastructure development		Cognitive	Routine practices around allocation of space for depots and their development	N.A.	N.A.	STU/ State Government	To improve or not improve the bus system	Operational & Financial efficiency
		Regulative		N.A.	Provision of depot space enforced through penalty provisions in case of default	STU/ Central Government		

				in PPP contracts			
	Normative		N.A.	Political commitment towards depot space provision	STU/ State Government		
Service levels	Cognitive	Routine practices around attainment of service levels	N.A.	N.A.	STU	To provide or not provide higher service levels	Service levels
	Regulative		N.A.	Service levels incorporated within PPP contracts	STU		
	Cognitive	Understandings around what service levels are attainable	Higher levels considered attainable through PPP	N.A.	STU	To provide or not provide higher service levels	Service levels
	Cognitive	Expectations of service levels	Higher expectations of comfort	N.A.	Users	To have or not have higher service levels	Service levels

6.5.1 Operational and financial efficiency

The change with the most widespread ramifications is occurring within the dimension of operational and financial efficiency where regulative and cognitive rules related to preferred O&M models are changing from STU owned and operated to public-private partnership (PPP) models. The launch of the FAME II scheme saw the creation of a new regulative rule regarding PPP being the only permitted O&M model for buses purchased with FAME II funding [DOC6]. Prior to FAME II, cognitive rules guided STUs and state transport departments who were free to choose the O&M model that suited them. Indeed, there was no condition regarding the O&M model within previous central government funding schemes for purchase of buses by STUs, such as the JnNURM [DOC2] or FAME I [DOC5].

The introduction of a new regulative rule regarding the O&M model can be attributed to three factors (T1 – T3, IC1, IC2). Firstly, one of the key learnings from previous central government bus funding schemes had been that the STU owned and operated model was usually inefficient in terms of high operational costs which yielded low levels of service quality and revenue. Many STUs did not have the institutional capacity to operate and maintain the buses properly. As a result, within a few years, the buses purchased under the grant would stop being operated and be left to perish. Secondly, post introduction of e-buses under the FAME I scheme, the view that offloading the 'technology risk' to the private sector was a sensible strategy became widely held within the national government and STUs: e-buses were a relatively new and unproven technology and thus carried the risk of financial losses if the technology turned out to be eventually impractical for use (e.g., if the buses were to catch fire frequently or break down in high temperatures in the summer). Besides, the nascency of the e-bus technology also meant that the risk of STUs not having the technical capacity to operate and maintain the buses was even higher. It made sense for the national government to promote a PPP model with the bus manufacturer as a key partner to reduce the 'technology risk' for STUs. Finally, the BJP, the political party leading the national government when both FAME I and II were launched, is well-

known for its centre-right / pro-privatization leanings. As one interviewee (T2) noted, "*a new technology often brings the possibility of government pushing down other ideas that they may have*".

Beyond the introduction of a regulative rule, cognitive rules have also changed (T1-T4, STU 1-STU 9). Electrification is triggering changes in attitudes of STUs towards PPP models of O&M. As the up-front purchase cost of e-buses is significantly higher, PPPs are becoming the preferred O&M model for STUs. Specifically, the gross cost model is being employed, whereby a private operator bears the cost of purchase and O&M of the bus, operates on parameters set by the STU, and charges a fee on a per operated kilometre basis to the STU. This shift can again be attributed to various reasons. Firstly, a PPP model helps the STU to spread out the capital cost of the bus over many years, transfer it to the operator, and avoid the hassle of raising debt. Secondly, the per kilometre cost quoted by private operators in many tenders has been comparatively low and even lower than diesel buses in certain cases, i.e., as one interviewee (STU4) noted "*with gross cost, the e-bus is starting to outprice [become cheaper than] diesel buses*". Lower cost of operations is often of great importance to STUs because many are struggling financially (Patel et al., 2019). The low cost can be attributed to strategic moves by new manufacturers seeking market capture, economies of scale, and to the lower total cost of operations (TCO) of e-buses over diesel buses [DOC8]. A central government agency, Convergence Energy Services Limited (CESL), was tasked with aggregating the demand for e-buses from various STUs under FAME II and issuing a joint tender, thus helping bus manufacturers to receive bulk orders [DOC9]. The shift in cognitive rules is evident from the fact that many STUs such as the DTC, BEST Undertaking and NMMT that did not have a tradition of opting for PPP models are now choosing to run e-buses on PPP even outside of FAME II funding, i.e., outside of regulative rules.

Another related and significant change within this dimension pertains to e-bus manufacturers (henceforth referred to by the industry term of OEMs or original equipment manufacturers) becoming the private operator. Prior to the onset of e-buses, OEMs had a very clear role of manufacturing and supplying the buses to the STU or private operators, and in limited cases providing maintenance services on a contractual basis [DOC14]. They were not engaged in operations. However, OEMs are now in charge of O&M of e-buses for all STUs that have purchased them under the FAME II scheme [DOC10]. The reason for this shift is again linked to 'technology risk' (STU1 – STU9, T1-T4). Putting the OEM in charge of O&M benefits STUs because OEMs know best how to operate and maintain e-buses as a new technology in ways that minimize accidents and breakdowns and maximize performance (e.g., through proper training of drivers). Besides, they are also best placed to source the spare parts needed for maintenance and repair: an interviewee (STU5) noted, "*it's their bus, end of the day they know best how to run it, how to maintain it*…". OEM participation is formalized within bidding conditions that require the bidder to have a tie-up with an OEM (ibid.).

Electrification is also changing cognitive rules around understandings of who can manufacture buses. While previously bus manufacturing was considered the rather exclusive domain of a limited number of well-established OEMs, the advent of e-buses has diminished this understanding. Prior to the onset of e-buses in the market, Tata Motors (TM) and Ashok Leyland (AL) together commanded the bulk of market share (48% in 2017-18) of diesel and CNG buses [DOC11: p. 7]. This trend somewhat continued during the FAME I scheme whereby TM accounted for 240 out of the 425 e-buses (56%) purchased under the scheme [DOC12: p. 31]. However, under FAME II, as of 2020-21, Tata Motors and Ashok Leyland only accounted for 620 and 65 e-buses respectively from a total of 3,200 e-buses purchased (21%). Other new entities, including Olectra-BYD, PMI-Foton and JBM-Solaris, account for 75% of the purchase orders (ibid.). All three are joint-ventures setup between Indian companies otherwise engaged in

manufacturing various goods and Chinese or European EV-manufacturing companies. They were all set up after 2015, the year in which FAME I was launched [DOC15].

This change in cognitive rules can be attributed to electrification taking away the technological advantage major OEMs had in the form of expertise regarding engine manufacturing. While the interviewees from the OEMs did not concede this point, it was corroborated by other interviewees (T1, T2, IC1). All e-bus manufacturing companies in India, whether the older OEMs such as TM and AL or the newer ones like Olectra-BYD, are importing battery cells or the entire battery pack given that manufacturing the battery cells comprises the most intricate part of manufacturing an e-bus. Dependency on a foreign manufacturer for battery cells has levelled the playing field at present for bus manufacturers. If one can configure the battery supply, becoming an e-bus manufacturer becomes rather straightforward. One interviewee (T4) noted, "*…once you have the battery, the rest is like a Class 12th* [the final year of upper secondary school in India] *science project*". A classic case is that of JBM-Solaris, whereby JBM, a leading auto-component manufacturer [DOC19], previously used to supply bus bodies to TM and AL but now is manufacturing its own e-buses by simply procuring batteries from Solaris.

6.5.2 Funding

The transition to e-buses is also triggering change in the politics of funding of buses through creation of new normative rules and regulative rules. These new rules are in turn linked to change in a cognitive rule concerning the symbolic meaning of buses. Several interviewees (STU1 – STU 9, T1-T3) observed how e-buses are considered 'modern' and come with a "*glamour quotient*". This makes them more appealing to politicians, and thus, more likely to garner political support for funding than diesel/CNG buses that are perceived as unglamorous necessary and 'pro-poor' infrastructure. This change can partly explain a concerted focus on e-buses under FAME II which is indicative of a new normative rule that sets a preference for funding of public transport against private transport. At 41%, e-buses took up the largest share

of the overall budget for eligible transport modes in FAME II with electric cars excluded from the scheme [DOC3]. During the FAME I scheme there was no priority set for any mode [DOC5]. An explicit priority for public transport needs to be considered as a new normative rule in light of the wide range of implicit subsidies that private transport, especially cars, enjoys through massive expenditures on road building and expansion, allocation of land for parking at non-market prices, and lower road tax than buses (see Gopakumar, 2020).

The change in cognitive rules can also explain the creation of regulative rules around bus funding at the level of state governments in some cases. Providing funding for diesel/CNG buses has always been understood as a routine administrative function of state governments. However, electrification has shifted bus funding from an administrative function into the realm of electoral politics, particularly since the launch of FAME II in 2019, with state governments being increasingly eager to publicly display their intent to fund e-buses, as a proxy for their commitment to providing 'modern' infrastructure to the public [DOC16]. Thus, certain states, including Maharashtra and Odisha, have included e-bus funding within their policies on electric mobility (see Niti Aayog, 2023), thereby bringing bus funding under the umbrella of regulative rules.

6.5.3 Infrastructure

Electrification is also triggering changes in the politics of bus infrastructure provision. Lack of parking space has been a long-standing problem for bus operations in Indian cities [DOC17]. However, e-buses need dedicated charging infrastructure which can typically only be provided in depots and terminals, as one interviewee (T3) noted: "*they* [operators/ STUs] *can't leave the buses overnight on the road anymore*". Consequently, new regulative and normative rules regarding provision of parking spaces for buses are being developed to address an issue and situation that was previously shaped by a cognitive rule and a matter of routine practice. The creation of a regulative rule is a by-product of the shift to a PPP model for O&M. In 2019, Niti

Aayog published a ‘Model Concession Agreement’ (MCA), which is a standardised contract document that can be used by STUs for signing agreements with private operators for e-bus O&M [DOC1]. The MCA clearly stipulates the obligations of the public agency to provide proper depot space to the private operator with provisions for financial penalties for failure to do so (ibid. pp. 10, 42). In contrast, within the guidelines for the JnNURM bus funding scheme of the central government launched in 2013, provision of depot space was mentioned as a routine condition to be met without any provision for financial repercussions in case of default [DOC2: pp. 5-6].

Moreover, normative rules around depot space provision are also developing. This is evident in the political interest in declaring their intention to provide parking space for e-buses [DOC18]. Provision of depot space is shifting from a matter of routine practice towards a sense of moral commitment on part of the government to do so. Earlier, a failure by the government to provide depot space may have been viewed in the public eye as a typical case of administrative inefficiency, but with the advent of e-buses it is considered as a political failure to embrace or move towards modernity (T1, T3). This can, again, be linked to the changing cognitive rule regarding the symbolic meaning of buses.

6.5.4 Service quality

Electrification, and the associated introduction of PPP, is changing the politics of service levels. Typically, management of service levels has always featured within cognitive rules for STUs. STUs, as a matter of routine practice, set up internal service quality (e.g., cleanliness, punctuality, driving quality, etc.) and efficiency (e.g., fuel economy, frequency of breakdowns, etc.) benchmarks, and strategies to achieve them. STUs only have the lever of financial incentives for their staff to induce the attainment of these benchmarks. However, with the shift to PPP-based operations, new regulative rules regarding service quality and efficiency are developing where binding targets are set under PPP contracts. Operators are liable to financial

penalty for non-attainment of targets [DOC4: p. 123]. Financial penalties, a more effective method of compliance than incentives, are not introduced by STUs for their own staff as they would run afoul of public sector employment rules (T2, T3).

Furthermore, cognitive rules around understandings of what service or efficiency levels are attainable are also changing, both for the STUs and bus users. For STUs, this is evident in differences between the levels set out in the PPP contracts that are typically higher than what the STUs typically attain themselves. This can be attributed to the issue of financial penalties and incentives described above. While the magnitude of difference may vary across STUs, the following example is helpful. The target for accident rates set out in the tender document published by BEST Undertaking, Mumbai in 2021 for hiring a private operator to operate and maintain e-buses was (less than) 0.1/1,000 operated km [DOC4: p. 116]. In comparison, for the year 2019-20, the accident rate for buses operated by BEST was 6 accidents/1,000 operated km, 60 times that of the level stipulated in the PPP contract [DOC13: p. 125]. For users, cognitive rules around user expectations of service levels are also changing. One interviewee (STU 7) noted how the introduction of air-conditioned buses and absence of noise from the engine has led to an increased expectation of comfort associated with riding in the bus. This has a rather important implication, as discussed in the next section.

6.6 Discussion

The results show changes occurring in existing rules and the creation of new rules across the four dimensions of operational and financial efficiency, funding, infrastructure and service levels. This section discusses what these changes mean for the shifting politics of bus systems, the implications of that shift, and how do this study's findings help expand the scholarship on transition politics.

The observed changes in rules are both shaping and being shaped by the ways in which tradeoffs between competing interests are resolved, thus altering the politics of bus systems.

The shift towards PPP, in particular, is triggering multiple changes (Figure 18). Within the operational and financial efficiency dimension, a new regulative rule mandating PPP model under the FAME II scheme has significant ramifications. It typically shifts the tradeoff towards operational and financial efficiency as well as service levels away from employee protection by taking the active tradeoff out of the hands of the STU.

Changing cognitive rules regarding STU attitudes towards PPP are similarly shifting the trade-offs in favour of efficiency and service levels. STUs are often associated with poor service levels and inefficiencies, with the possible exception of some agencies like BMTC (Singh, 2017). One of the reasons for this is the lack of any mechanism to enforce service levels benchmarks upon government staff, while this kind of enforcement is rather straightforward in the private sector. Besides, the PPP model that was implemented as part of the FAME II scheme (and in general across urban bus systems in India now) is the gross cost model, where all service parameters (routes, frequencies, timings, service levels, etc.) are laid down by the STU and the operator is paid or penalized on the basis of performance against those parameters. An independent consultant remarked how very few STUs, such as BMTC, feel confident that they can provide better service levels than the private sector. This factor further aids the changing attitudes in most STUs towards PPP and the associated shift in trade-offs. Furthermore, even in the case of BMTC, given the absence of comparable empirical evidence, it is worthwhile questioning if that confidence among their officials is rooted more in ideological commitments against privatization which do not get challenged because their service and efficiency levels are one of the highest in the country.

Changing understanding (cognitive rule) of the role of the manufacturer from being purely the supplier of buses to supplying, operating and being in charge of maintenance of buses enables the shift of tradeoffs towards operational and financial efficiency away from OEM profits. With OEMs being in charge under a PPP contract, buses are typically driven and maintained better.

As a result, the overall age of buses in operation increases, which directly impacts the financial efficiency of STUs. The change in cognitive rules related to understandings of who can manufacture buses also shifts the tradeoffs in favour of financial efficiencies away from OEM profits. This happens as the emergence of new bus manufacturers intensifies market competition and lowers bus prices. In the case of service levels, the shifting of benchmarks and targets from cognitive to regulative rules under the PPP contracts shifts the tradeoffs in favour of higher service levels. This in turn helps to change cognitive rules around understandings of what level of service is attainable and to increase user expectations of service levels, both of which reinforce the shift in trade-offs.

Overall, the analysis suggests shifts in trade-offs towards improved bus systems with higher efficiency and service levels. This shift is the combined result of the changes in regulative rules towards PPP operation as well as the creation of new regulative rules about bus funding and (charging) infrastructure development at national and state levels and changes that are reinforced by normative rules around both bus funding and infrastructure creation. These rule changes are triggered in turn by shifting notions of a bus system from being a necessary infrastructure to a modern amenity.

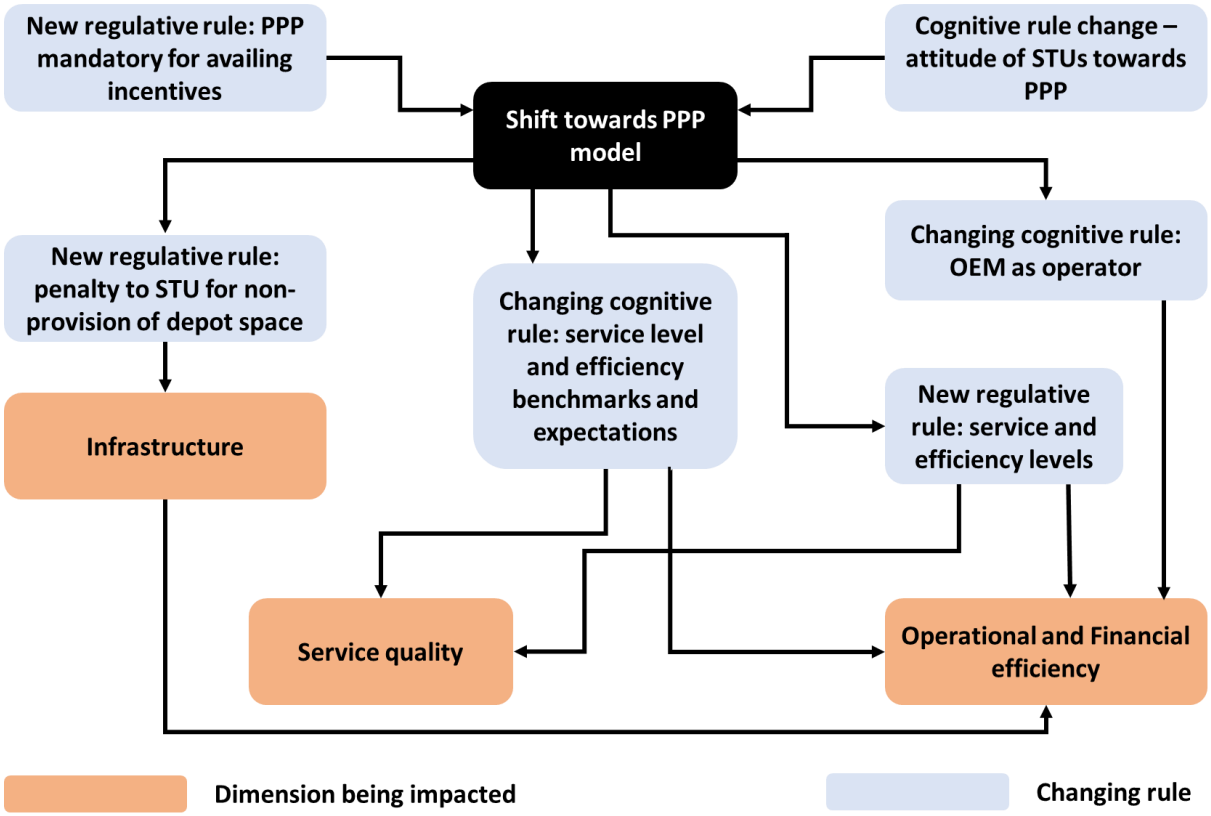

Figure 18: Changes in rules across dimensions being triggered by a shift to PPP-based operations

These shifting notions and rules changes are on many levels desirable, though it is also clear that they are creating not only winners. Bus operators and many bus users may benefit, but STUs and bus drivers and other staff less so. The expansion of PPP models may create job losses in the public sector in the short to medium term. Furthermore, if adequate safeguards regarding employment standards are not ensured or put in place, PPP-run bus systems could become vulnerable to forms of wage exploitation. At a time when questions about mobility justice and just transitions are being raised in the context of electric mobility and more generally low-carbon mobility transitions (Henderson, 2020, Prause and Dietz, 2022, Schwanen, 2021b), this study shows that new dimensions of potential injustice can emerge as regime rules evolve. It is pertinent for transition scholarship to examine the possibility of low-carbon transition pathways championed by incumbent governments becoming a proxy for capitalist restructuring

of major industrial and/or employment sectors. Similarly, the association of 'modern' with air-conditioned (AC) buses may result in increased supply of AC buses. This can increase service levels in cities where previously AC buses were not operational. However, in cities like Delhi AC buses have been operational for many years, with a differentiated pricing system for AC and non-AC buses: fares for AC buses can be double that of non-AC buses [DOC21]. In such cases, a shift in the balance of supply of AC and non-AC buses can start to make the bus system unaffordable to many of its existing, financially vulnerable users.

The discussion above generates several useful insights for the transitions politics scholarship by highlighting the changing politics of the case study. It shows how an investigation of changes in a ST regime's rules can help scholars to understand how the politics of a sociotechnical system are changing, as the rules are associated with the process of making tradeoffs to resolve competing interests associated with the system. It also demonstrates how changes in one type of rule can trigger the creation or change of other types of rules (e.g., a new regulative rule helping change normative or cognitive rules) and how that can be intrinsically linked to the changing politics of a ST system. This study opens up a new conceptual pathway to expand the scholarship on transition politics that has so far not engaged in detailed analysis of regime rules as an analytical approach. Such an approach could generate interesting insights in transition research focused on mobility and other societal functions. For example, growing scholarship on the impact of the transition to electric and autonomous mobility on automobility could benefit from a focus on its changing politics by examining changes in cognitive or normative rules.

Furthermore, from a transition perspective, the study shows how the new e-bus regime will look substantially different than the diesel bus regime it is replacing. The changes will be much wider than just the powertrain and associated infrastructure and O&M practices. User meanings, service level expectations, market structure, role of various actors, and models of financing, operating and maintaining buses are changing too. Moreover, it shows how electrification can

be tied up with issues of just transitions in ever new ways that are pertinent for transitions scholarship to consider and engage with.

As stated in Section 6.4.2, the study took a multi-scalar perspective to examine the changes given the multi-scalar nature of urban bus systems in India. However, through the study I did not find any obvious differences in terms of how the process of making trade-offs is changing at the national level and the city/ state levels or between cities. This does not necessarily suggest that differences exist. Further research would be needed to examine the nature and extent of such differences, if at all, using a tailored research design. For instance, a greater number of and diversity of cities could be considered in an explicitly comparative research design.

Finally, while examining the changing politics of other transport modes undergoing electrification was not possible within the scope of this study, future studies could undertake a comparative assessment of changes in rules of various adjacent regimes in the whole system of passenger mobility, and the impact of such changes on the politics of the whole system.

6.7 Conclusions

This study has examined the changing politics of sociotechnical (ST) systems undergoing a transition, using a case study of electrification of urban bus systems in India. By employing an understanding of politics as the process by which trade-offs between competing interests are resolved, the paper has argued that changes in cognitive, normative, and regulative rules of a ST regime undergoing a transition can help scholars to understand the changing politics of ST systems. The paper substantiates this theoretical framework with the help of a case study of electrification of urban bus systems in India.

Empirically, the study has considered cognitive, normative, and regulative rule changes within four dimensions of the bus system: operational and financial efficiency, funding, infrastructure, and service levels. The study finds multiple changes taking place within cognitive, normative, and regulative rules across these dimensions. Some changes are happening within the same

category (such as changes in cognitive rules regarding attitude of STUs towards PPP models of O&M). In other cases, new types of rules are developing across the four dimensions that have implications for the way trade-offs are resolved (e.g., regulative rules concerning PPP being the only permissive O&M model for e-buses purchased under the FAME II scheme). Overall, the shift towards PPP models is the most significant, which is both triggered by changes in regulative and cognitive rules and in turn precipitating a wide range of changes in other rules (Figure 18). Furthermore, though the study adopted a multi-scalar perspective to examine the changes in rules, it did not find any clear differences in the changes to the rules at different scales.

The observed changes in rules, and thus the politics, indicate for the most part shifts occurring in trade-offs towards improved bus systems with higher efficiency and service levels. However, caution is advised about possible unintended consequences of the shift in politics as well as questions of just transitions that arise with the push for PPP model of O&M in terms of just outcomes for all (Heffron and McCauley, 2018, Newell and Mulvaney, 2013). For example, changing perceptions of buses as a modern amenity should not become equated with buses being mandatorily air-conditioned. With many cities having differential tariffs for AC and non-AC buses, an emphasis on purchase of AC e-buses may start to make urban bus systems unaffordable for many of their key users.

Furthermore, the emphasis on e-buses should not turn into a vanity project for politicians. Indian cities are in dire need of large-scale expansion of their bus systems given mounting urbanisation pressures. With the e-bus industry still in its nascent stage, care should be taken to ensure a transition to e-buses does not come at the cost of slower expansion of cities' public transport supply than could be achieved through purchase of diesel/CNG buses. Such a tradeoff might defeat the very purposes of electrification (air pollution/carbon emission reduction) if decreasing supply of public transport forces people to switch to 2Ws, for which per

passenger-km CO_2 emissions remain higher than buses (WRI, 2015). It may again render urban transport systems more unequitable by reducing affordable travel options, which resonates with concerns about electrification entrenching existing or creating new forms of inequalities (see Curran and Tyfield, 2020).

The study's key theoretical contribution is to offer a novel way to understand the changing politics of ST systems in transition. In doing so, it diverges from and helps expand transitions politics literature that has largely focused on the politics of system change itself by highlighting how transition affects the inherent politics of the system. By connecting the concepts of regime rules to the politics of ST systems, it offers a conceptual contribution to transition politics scholarship that has so far not engaged with such an analytical approach. The conceptual approach used in this paper could be applied to other contexts, such as to examine the shifting politics of automobility in the context of electrification. Through its focus on regime rules, it also responds to calls to focus on the role of structures in transition politics (Kok, 2023). A secondary contribution of this study is that it helps grow attention to the underexplored theme of bus systems (e.g., Mutter, 2019) within the literature on the politics of mobility transitions that has often been preoccupied with automobility (e.g., Kester, 2018).

CHAPTER SEVEN: CONCLUSIONS

7.1 Introduction

This study set out to understand the different ways in which the transition to electric mobility in India is shaping and being shaped by the politics of urban passenger mobility systems in the country. Urban passenger mobility systems are associated with a wide range of competing interests. Politics lies in the processes by which tradeoffs between these competing interests are resolved. This study has examined what happens when a sociotechnical transition like electrification of urban passenger mobility intersects with this politics, i.e., how electrification is shaped by and in turn shapes the process of resolving the various tradeoffs involved.

To do so, the study has selected various avenues along which this intersection occurs and formulated three distinct research questions or themes for investigation. These have been addressed through the deployment of diverse methods like process tracing, critical discourse analysis and thematic analysis of a wide range of data sources like semi-structured interviews, news archives, official reports, and EV sales statistics.

7.2 Findings from the study

The first research question asks how and why some of the early national policies on passenger transport electrification were created. The early national policies proved instrumental in triggering the ongoing transition to electric mobility in India. The study suggests that the transition was put in motion by an intricate interplay of structure and agency: the policies were created by policy entrepreneurs (PEs) – i.e., top officials in the concerned departments and ministries of the national government and the automobile industry, who were able to discursively construct landscape pressures for the transition. To do so, they connected landscape developments related to policy and political demands for growth in manufacturing with tensions within the fossil-fuel vehicles regime pertaining to an inability to help India become a global leader in manufacturing. The PEs recognized that India could not compete

with legacy automobile manufacturing leaders like the USA, Japan, and Germany because of the late liberalization of India's economy since 1991. However, in their view, electric mobility offered a pathway for India to become a global leader in automotive manufacturing at a time when most countries, with the possible exception of China, had similar levels of expertise and capabilities as India around EV manufacturing. This necessitated the creation of supportive policies at a time when the EV industry in India barely existed and EVs did not feature within the policy discourse related to urban passenger mobility.

Through the discursive construction of landscape pressures, the PEs succeeded in enacting the early policies and ensuring the necessary political buy-in for transition to electric mobility. They used a window of opportunity created by the confluence of concerns around ramping up India's manufacturing sector around the time of the 2008 economic crash, imminent national elections in 2009, and the incipient policy awareness around electric mobility on account of India hosting a conference on technological innovations for sustainable mobility in 2008. The policy entrepreneurship qualities of the actors were manifested in, for example, how they mobilized linkages between EVs and long-standing policy issues of energy security and air pollution to legitimize the creation of policies for EVs, or ensuring political support for the policies by getting them included in the budget speech of the then Finance Minister in February 2011 and in the President's speech to the joint parliamentary budget session in March 2012.

The second research question focused on the potential futures for urban e-mobility in India that the news media discourse has legitimized and how this legitimization process is linked to the politics of passenger mobility. Informed by Critical Discourse Analysis and employing the concept of sociotechnical imaginaries, the study has analysed 275 articles on electric mobility from three of India's most widely circulated English newspapers between the period of April 2009 and August 2020. It has identified two contrasting imaginaries regarding electric mobility in India, with one revolving around 'environmentally friendly automobility' and the other

concentrating on 'electrification of rickshaws for employment.' The first imaginary is a vision of a desired mobility future centred around uninhibited growth of cars that is supportive of and supported by electrification, with the latter linked to the removal of key constraints on the growth of automobility like air pollution and CO_2 emissions. The second imaginary of 'electrification of rickshaws for employment' is a vision of a desired mobility future where unfettered growth of e-rickshaws is not permitted (in contrast to e-cars) and this form of transport is rather imagined as a source of employment.

This first imaginary is grounded in deeply normative societal ideas about cars being not just the ultimately preferred means of mobility, but also as the quintessential symbol of success and high socioeconomic status in a modern urban India (see Butcher, 2019, Edensor, 2004, Nielsen and Wilhite, 2015). These normative ideas are performed throughout the discourse on transport modes, policies, infrastructure, and subjectivities related to electrification by offering electric cars a unique position in comparison to e-rickshaws, e-buses, and e-2Ws. There is a balanced coverage of e-cars across different categories of news articles; attention is uniquely paid to their system-wide transition dynamics; electric cars are exclusively linked with India's electrification targets and ambitions; and e-cars are foregrounded as the solution to issues of air pollution and climate change. The discourse on policies reduces the need for policy support for transport electrification to subsidies for ensuring an unfettered growth of e-cars. The need for public charging infrastructure is played up in the discourse as crucial for e-car adoption and diffusion, and the infrastructure needs of other modes or technological alternatives like battery swapping that do not benefit e-cars as much as e3Ws and e2Ws are marginalized. Finally, the discourse constructs automobile users as the imagined principal agents of the transition.

The second imaginary of 'electrification of rickshaws for employment' is rooted in deeply normative ideas around e-rickshaws being an undesired presence on the street on account of the lower socioeconomic status of their typical users. This becomes evident in the

foregrounding of their role in providing employment to the lower socioeconomic sections of society and the marginalization of their potential role within the passenger mobility system. The discourse evidences a performative element to the normative ideas around e-rickshaws by foregrounding their aspects of legality, viewing their charging infrastructure needs through the lens of safety and electricity theft rather than as a support mechanism, and voicing the opinions of e-rickshaw drivers rather than users.

Finally, the third research question that the study has addressed concerns what changes, if any, electrification is triggering in the politics of urban bus systems in India, and how. Here, the investigation has been based on the premise that studying changes in the rules of the urban bus regime can lend insights into the shifting politics of the system, since the rules are key to the process by which tradeoffs between various interests associated with the bus system are resolved. It has been suggested that the relationship between rules and tradeoffs plays out in three ways. Firstly, regime actors directly negotiate tradeoffs, guided by existing rules, or modifying them, or creating new rules in and through their practices. Secondly, tradeoffs can be resolved indirectly even if they were not explicitly intended to be through the chain of events set off by the action of regime actors. Finally, trade-offs can also be resolved passively, whereby without any explicit action, socio-material realities of the system reinforce certain rules that serve particular set of interests.

The study has found multiple changes taking place within cognitive, normative, and regulative rules across four dimensions of the bus system: operational and financial efficiency, funding, infrastructure, and service levels. In some cases, new rules are being created that are taking precedence over previously existing rules. An example is the creation of a new regulative rule concerning PPP being the only permitted O&M model for e-buses purchased under the FAME II scheme that is overriding previously held cognitive rules comprising STU attitudes towards PPP. This new rule also is arguably the most significant change in rules, as it is helping to trigger

changes in rules across other dimensions, such as changing cognitive rules around expectations of users over service levels as well as new regulative rules around attainment of service levels. In other cases, changes are happening within the same category of rules, such as changes in cognitive rules regarding the symbolic meaning of buses changing from 'necessary infrastructure' to 'modern amenity', which has implications for political support towards urban bus systems.

The observed changes in rules, and thus the politics, indicate for the most part shifts occurring in trade-offs towards improved bus systems with higher efficiency and service levels. However, the study cautions against possible unintended consequences of the shift in politics (e.g., a disproportionate rise in air-conditioned (AC) buses that may price out low-earning commuters in cities with differential fare system for AC and non-AC buses) as well as questions around just transitions that arise with the push for PPP model of O&M that is centrally linked to many of the changes occurring in the politics (e.g., employment welfare and security of bus drivers).

7.3 Contributions of the study

The overall contribution of my thesis is to demonstrate how the ongoing transition to electric mobility in India is deeply interwoven with the politics of urban passenger mobility systems in different ways, and how that has profound implications for the future of (electric) mobility in India and for scholarly understandings of sociotechnical transitions. While these contributions do not, by any means, aim to address all aspects of the politics of the ongoing transition to electric mobility in India, they help to demonstrate why it is pertinent to do so. On a more detailed level, the contributions of this study can be categorized as thematic and geographic, practice or policy oriented, theoretical, and methodological.

7.3.1 Themes and geography

Firstly, from a thematic standpoint, the thesis helps to address gaps related to mobility transitions in emerging economies within the transition politics literature (Schmid et al., 2021).

The study shows how the transition to electric mobility in India is entangled with the multimodal politics of passenger mobility systems, in ways that are unlikely to occur in developed economies where electrification of 2Ws or 3Ws is not particularly a policy concern. Further, while there has been work examining the politics of semi-or non-regulated transport (e.g., Dutt, 2022a, Dutt, 2022b, Sengers and Raven, 2014), my study is the first to show a sociotechnical imaginary in respect of electric rickshaws in India. Furthermore, this study helps to grow the literature on the politics of bus systems and their transitions in India which so far largely been examined within the theme of bus-rapid-transit systems.

From a geographic standpoint, as mentioned in Section 1.6, my study seeks to both emphasize the significance of examining India as a site of an ongoing significant energy and mobility transition in its own right and also use India as a case study whereby its findings can find application in other geographies too. The findings of the first research question in Chapter 4 show how the motivations behind the transition developed organically and were rooted in domestic political economy, even though they were not unique in the sense that there were similar developments in other countries like China around the time. However, the analysis suggests that, within national policymaking circles, no connections were being made with developments in other geographies. On the other hand, some findings are likely to resonate with developments in emerging as well as developed economies. My study shows the significance of examining the intersection of multi-modality of urban transport systems with low-carbon transitions like electrification. Multi-modal transport systems are not unique to India and can be found in many emerging economies, such as Bangladesh, Kenya, or Indonesia. Thus, this theme could be examined in further studies in those geographies where transport systems are multimodal. Finally, the approach I have developed in Chapter 6 to examine the changing politics of bus systems undergoing a transition can be applied in any geographic context to examine the changing politics of automobility or other transport systems.

7.3.2 Policy and practice

The study also makes a number of practice or policy related contributions. At the overall thesis level, the evidence points towards the existence of a clear class dynamic within passenger mobility systems in India which is intersecting with the process of electrification and being reinforced and disrupted in different ways. The pre-eminence of cars within urban mobility systems is becoming entrenched as a result of the economic drivers of the transition to electric mobility and through the construction of imaginaries of electrification centred around cars. At the same time, electric rickshaws are being marginalized as an undesirable component of the transition through indifference within the policymaking logic driving the transition and through a broader societal discourse of (the need for) regulation and control. Finally, bus systems are increasingly obtaining connotations of middle-classness as electrification renders them as 'modern infrastructures' and through increased policy and political support. They, nonetheless, remain peripheral to imaginations surrounding the future of electric mobility in print news media. This section expands on these points below and shows how the evidence presented in empirical chapters points towards these conclusions.

Electrification is reinforcing the installation of automobility in Indian cities (Gopakumar, 2020). While national policies seem to have moved away from a priority for electrification of cars[11], this shift does not necessarily amount to a change in politics. As Chapter 4 shows, the genesis of the transition to electric mobility was rooted in ideas of India becoming a global leader in manufacturing. Automobiles are central to the realisation of this imagination. To some degree, there is evidence of this idea persisting and driving the transition, such as in the launch of a specific scheme by the national government promoting the manufacturing of electric cars in

[11] A conversation held in March 2024 with a senior official from the Government of India working on electric mobility revealed that cars, and even taxis, were emphatically ruled out of the purview of the upcoming FAME III scheme (the third iteration of the financial incentive scheme), while the focus on e-buses will be made stronger and on 2 and 3Ws weaker. Nonetheless, there is a possibility that a separate scheme for electric cars may be created in the future.

2024 (Press Information Bureau, 2025). Therefore, a future policy pivot towards electrification of four-wheeled cars may yet happen. Moreover, as Chapter 5 shows, aside from the national policies and political economic concerns, mass media imaginations around desired futures that are made possible through electrification were centred around cars. While the analysis in Chapter 5 was limited to pre-2021 print media discourse, it is unlikely that the imaginations may have dramatically changed since 2021 as they are rooted in deeply normative ideas around desired forms of mobility. This means that a potential future policy pivot towards electric cars is not likely to be contested or challenged within the mass media. Finally, in the vein of findings of Chapter 6, further research could consider the regulative, normative and cognitive rules that make up the automobile regime to investigate if the politics of the latter are changing or rather perpetuated through electrification.

Electric rickshaws, to some degree, represent a paradoxical aspect of India's EV transition where a phenomenal growth of e-rickshaws in some Indian cities[12] was treated with disdain within the political, policy and news media discourse alike, while at the same time national policies were created to instigate the transition to electric mobility. Findings from the fourth chapter are helpful here. Electric rickshaws were vilified in part because they did not fit within the political economic aspiration underlying the national policies on electric mobility: e-rickshaws would not help India become a global leader in manufacturing. As such, they at best remain irrelevant and at worst undesirable to policymakers interested in ramping up India's manufacturing capabilities through e-mobility. Findings from the fifth chapter help paint a more complete picture. The vilification is also linked to the class politics associated with the passenger mobility system, whereby e-rickshaws do not fit the aspirational urban middle class imaginations of a desired mobility future shaped and enabled by electrification. This class

[12] It is estimated that India had 1.5 million e-rickshaws in 2018, a number that exceeded the total electric vehicles sold in China between 2011 and 2017 (Bloomberg, 2018).

politics encourages unfettered growth of electric cars but reserves a great degree of discomfort towards 'unregulated' growth of e-rickshaws.

Electrification is increasing the prominence of urban bus systems. As Chapter 6 shows, electrification is shifting the politics of bus systems in ways that many users would consider to be largely positive, though certain risks remain, including the possibility that e-buses become a vanity project for politicians and concerns around just transitions related to labour conditions of drivers in the private sector. However, building on the findings of Chapter 4, it is worth reiterating that electric buses are not likely to enable India to become a global leader in EV manufacturing. Buses cannot generate enough demand for battery cell manufacturing that would create economies of scale. It is, therefore, not given that the current policy focus on electrification of buses will continue in the long run. Finally, as Chapter 5 shows, electric buses are still considered a local concern within the national-level English language newspapers, and not central to the national-level efforts towards transition to electric mobility. Policy makers could do well to expend some efforts to gradually change the national-level mass media narrative around e-buses and try to position them as central to the political and policy imaginations around electrification.

Going beyond the findings of the individual empirical chapters, the thesis also points towards the past trajectory in terms of paths not taken as well as some recommendations for the future trajectories of e-mobility transition in India. Concerning the past trajectory, it is worth asking whether in the absence of political economic concerns, a less economically protectionist strategy may have been undertaken with regard to the early years of the transition. This is because such a strategy could, for instance, have combined fewer constraints on the import of EVs to let demand grow and active support of the domestic industry enabling it to expand rapidly and catch up with manufacturers abroad. From an environmental perspective, this could have potentially triggered a faster transition. Indeed, one of the reasons e-rickshaws grew

exponentially in India between 2010-2015 is because they were unregulated and driven by imports of cheap parts from China (Dutt, 2022a). For the record, this speculation about strategic choices in the early years does not at all imply a suggestion for such choices to be made today. For India to shift its dependence over time from the Middle East for oil to China for batteries can have disastrous geopolitical implications. The speculation does bring back the discussion to the central role of tradeoffs and politics in ST transitions. More specifically, it underscores again how low-carbon transitions can be deeply intertwined with the political economy within which they are situated. Indeed, as growing discomfort over the increasing imprint of Chinese EVs in the European and Northern American markets shows (e.g., Naughton, 2024), this point holds globally and not just for India.

Finally, this thesis make four recommendations with regard to the future trajectory based on the insights that have emerged from my study. Firstly, if the intent towards manufacturing leadership is genuine, regime destabilisation measures (van Oers et al., 2021) like supply-side measures are likely needed to force ICEV manufacturers to ramp up their EV manufacturing. Such supply side regulations could include mandates for minimum percentage of EV sales (Roychowdhury, 2024) or stringent fleet-wide fuel economy regulations which force manufacturers to vastly improve the efficiency of their ICE models and/or increase the percentage of EVs in their overall fleet sales, with the latter proving to be the technologically and economically more feasible option depending on how stringent the fuel economy standards are set (Anup and Deo, 2021). Secondly, while manufacturing leadership ambitions are understandable, policy makers could also evaluate other opportunities for global leadership if the push for transport electrification is aligned with India's existing strengths. For instance, a case could be made for India, with its well-known and established information technology (IT) industry, to develop a leadership position in the design and development of all IT aspects of EVs such as battery management and range optimization systems, algorithmic development for smart charging at scale, and vehicle-to-grid technology.

Thirdly, this study points towards political economic factors and electric mobility imaginaries that could enable electrification to further entrench automobility in Indian cities. Policymakers might do well to guard against this and ensure that mobility strategies do not adopt a myopic view of automobility's problems, i.e., believing electrification to be the ultimate panacea for urban mobility problems. It has to be said here that even from the sole perspective of carbon emissions reduction, until India cleans up its power sector, which is far from straightforward at present (Roy and Schaffartzik, 2021), EVs will not be significantly better than ICE vehicles (Bieker, 2021: p. 44) because of considerable CO_2 emissions associated with coal-fuelled power generation.

Fourthly, it remains important for policy to consider multiple modes and not only centre electric cars. The organic growth in e-rickshaws can and should be properly harnessed and integrated within urban mobility strategies, such as feeder to public transport systems. Moreover, as chapter 6 has also suggested, while the focus on electric buses is ostensibly a good idea, policy makers should ensure electrification does not effectively reduce the supply of public transport in cities over the next 5 to 10 years, for reasons like supply delays. This could have drastic consequences for the fulfilment of the mobility needs of the poor, congestion levels and air pollution if commuters, on account of lack of public transport alternatives, are forced to switch to petrol 2Ws (see Patel et al., 2019) that may remain in circulation for another 10-15 years.

7.3.3 Theory and methodology

At the overall thesis level, my research makes two main theoretical contributions. First, the study helps address the paucity of examinations of transition politics in emerging economies and the politics of mobility transitions (Schmid et al., 2021). In particular, it shows that the politics of mobility transitions in emerging economies is multi-dimensional. One of the dimensions relates to the political dynamics of regime change, specifically the dynamics of landscape pressures in sociotechnical transitions and the adaptive role of transition actors.

This study demonstrates how regime actors can interpret and link regime tensions with landscape developments and discursively construct landscape pressures, in the absence of strong and well-organised actors at the niche (Antadze and McGowan, 2017) or indeed landscape level undertaking that action. It also speaks to the scholarship on the political economy of transitions which often focuses on resistance from the political economy of the incumbent regime. Instead, it draws attention to promises of future political economic configurations offered by niches that can trigger a transition if regime actors consider them as more favourable than those offered by the prevailing technologies and infrastructures.

Another dimension pertains to the politics of whole system transitions, which have long remained undertheorized within transition politics scholarship but are now receiving increasing attention (Geels, 2018, Geels and Turnheim, 2022). My research shows how a whole system transition may potentially reconfigure competing interests existing between adjacent sociotechnical systems within the whole system, creating conflicts or contestations that are different to and beyond the dynamics of regime change that is often the subject of transition politics scholarship. The third dimension concerns how a transition affects the inherent politics of the system itself. My research shows how a sociotechnical transition can reconfigure the process by which tradeoffs are resolved between competing interests associated with a system that predate and exist independently of the transition itself.

The second contribution is to show how diverse concepts and conceptual frameworks can be brought into the service of understanding the political dynamics of transitions. For example, my research helps bring together the MLP and MSF frameworks by considering the problem stream as consisting of problematisations of selected landscape developments and demonstrates how transition actors can use a window of opportunity to link the problem stream with tensions within the regime to construct landscape pressures for transition and couple the problem, policy, and political streams to justify and create policies that may trigger a transition. Further,

by connecting the concepts of regime rules to the process by which tradeoffs associated with sociotechnical systems are resolved, the study offers a novel analytical approach to examine the changing politics of sociotechnical systems undergoing a transition. In doing so, it helps respond to calls to focus on the undertheorized role of structures in transition politics through its focus on regime as a structural element of a ST system (Kok, 2023).

Finally, the thesis also makes a methodological contribution by employing a process tracing approach to address the first research question. Process tracing has been applied in transitions research increasingly in recent years in various geographic contexts such as Germany (e.g., Derwort et al., 2022), Brazil (e.g., Benvenutti et al., 2023) as well as India (e.g., Haldar et al., 2024). The method of process tracing to establish causality has emerged from western developed economies where, in comparison to emerging economies, governance structures are more likely to have inbuilt accountability systems including proper and publicly accessible documentation of processes and events and established norms, practices and systems for access to key officials for research interviews. This has implications for carrying out process tracing in the latter contexts. The method crucially relies on evidence of processes and mechanisms that are typically well documented and accessible. However, in countries like India, proper documentation of meeting minutes may not always exist or if they do, they may not be easily (or at all) available. There may be similar issues around access to officials privy to the policy making process as highlighted in Chapter 3. Thus, in the Indian context, researchers may not be able to conduct process tracing exercises that are as thorough as they might like and as the prevailing literature suggests (Beach and Pedersen, 2019, Bennett and Checkel, 2015).

Nevertheless, an approach informed by the process tracing method can still be useful, provided researchers aim to be ambitious but flexible in terms of the detailing of the end output. Based on the experience gained in this study, this could entail, for example, focusing on the

consequences of certain events, which could have two benefits. Firstly, in cases where the full details of the event itself may not be available (e.g., not having access to the actual text of a memo), a focus on what the event was about and, more importantly, how it contributed to the chain of events that followed could be useful. Secondly, in cases where it may not be possible to ascribe an accurate and granular chronological timeline to the process, it could help with limiting oneself to placing events in sequences, possibly using qualitative descriptors of the distance between (sequential) events, such as 'close to' or 'immediately preceding', and situating the broad timeline within the relevant socio-political-temporal context (e.g., whether it was around the time of elections).

7.4 Limitations and avenues for further research

While this study goes a substantial distance in addressing some of the gaps in understanding of India's ongoing transition to electric mobility and its intersection with the politics of urban mobility, there remain multiple limitations to the research that may be addressed in further research.

The study has focused on the politics of early national policies created between 2010 and 2015. This was a logical and deliberate decision since many of the policies that have emerged since 2015 were built upon the foundation of that those early policies. However, it is also important to investigate the dynamics behind the creation of a wide range of national policies that have been created since 2015, particularly those that were not envisaged within the early policy frameworks (e.g., supply-side schemes like the Performance-Linked-Incentive (PLI) scheme for automotive manufacturing and battery manufacturing that were launched in 2021 but were not mentioned under the NEMMP 2020). Further, while the third research question adopts a multi-scalar approach to examine the changing politics of bus systems through the process of electrification, this study did not explicitly delve into the politics of state government policymaking over the last ten years. It would be useful to take a multilevel governance

approach and investigate the politics of policymaking at both state and national levels. It would be interesting, for example, to examine the types of actors and structures that prevail in policymaking at the state level, how these may differ from the national scale, and how the actions of policymakers at one level influence those at the other level. Thus, it would be interesting to consider to what extent policymaking on electric mobility in states is influenced by or otherwise independent from the policy landscape, political dynamics and the governance structure of the national level. Conversely, it would also be helpful to understand how the developing policy landscapes at state levels start to inform the national policy landscape, and the changing configuration of actors and structures within these evolving dynamics.

The significance of political economy within the context of transport electrification points towards a need for understanding the wider politics of low-carbon transitions in adjacent domains in India. Some efforts are already happening on this front (e.g., Shidore and Busby, 2019). Studies could be conducted to examine the evolving nexus of state, capital interests, and low-carbon transitions, such as for example, the decision of India's richest business conglomerate, Reliance Industries Limited, to invest in sodium battery cell manufacturing (Mukherjee, 2022). This is important on two accounts. Firstly, the owner of Reliance Industries Limited, Mukesh Ambani, is very close to the political leadership at national level. Secondly, focus on an alternative battery chemistry (that does not need lithium) offers a way to escape potential dependency on China in the long run for battery cell manufacturing that would have significant geopolitical ramifications.

Furthermore, the theme of policy entrepreneurship and its role in the governance of transitions in emerging economies like India and its implications remain fairly understudied. Anecdotal knowledge from my past work experience in India indicates that past transport policy interventions such as the massive push for Bus-Rapid-Transit systems or the augmentation of urban bus fleets were associated with certain policy entrepreneurs at the national, state and

city levels who championed those causes. Further studies could look at this and its implications for the governance of low-carbon transitions in India.

While the analysis of news media discourse is very useful, it stops short of evaluating the ways in which the discourse actually is shaped by and in turn shapes the politics. It would be helpful to look at the processes of news production and consumption in India which would provide a fuller picture, as has been done elsewhere (Scherrer, 2023). This would open up deeper understanding of the linkages between the mass media and social consciousness and imaginations, and of how these linkages lead to acceptance and marginalization of different transitions and transition pathways. It would also be very important to undertake a similar analysis of news media in other forms (television), other languages and other forms of media like social media, for all of them are also platforms where the politics of urban mobility are enacted. Finally, this study has only examined the imaginaries of electrification at the national level. It would be helpful to undertake similar examination at the scale of states or cities, where it is possible that a different set of imaginaries exist or are constructed (Mutter, 2019). Herein again, the analysis of news media in regional languages would be helpful.

While the study has examined the shifting politics of bus systems, it is difficult to place the exact implications of that without conducting a parallel examination of the shifting politics of other modes undergoing electrification. Here, one could be led by the approach taken in this study to undertake similar analysis of the changing politics of automobility, for example. That could also help complement some of the other findings from this study.

Finally, this study has adopted a specific lens to examine politics, i.e., the process of resolution of tradeoffs between competing interests. While this is a very relevant way, it is by no means the only way (as discussed in Section 2.5.1). Other approaches to examine the politics of electrification could be useful to build on and complement the findings of this study. For instance, an alternative lens of politics as power relations, which is a fairly common approach

in transitions politics literature (e.g., Geels, 2014), could be applied to examine how electrification is changing the distribution of power between various actors of the urban bus regime, such as the STU, central government, private operators, bus manufacturers, etc. Similarly, studies conducted in the Foucauldian tradition, as have been carried out in other contexts (e.g., Tyfield, 2014), could be useful to examine, for instance, how the discourse around electric mobility frames issues such as environmental sustainability, public health, and individual responsibility, and how these discourses shape urban mobility governance strategies. Also, while this study touches upon the role of political economy in India's ongoing EV transition, future work could also take a more political economy-centred approach to investigate, for example, how India's automobile industry's interests shape the policies around electric mobility. Finally, while this study touches upon the theme of just transitions in Chapter 6, there is much scope for examining the ongoing EV transition from a mobility justice perspective (Schwanen, 2021a, Sheller, 2018), looking at the effects of the transition on mobility levels of different types of users, wider impacts of EV transition and infrastructure on the urban fabric, livelihoods, and health and wellbeing.

Epilogue

In 2016, I used to rent an apartment in a relatively affluent part of Delhi. A rather ubiquitous presence in Delhi is the '*gali-wala Dhobi*' (street's laundry person): an informal semi-permanent setup, often at the corner of some streets, where a person or a family provides the service of ironing the clothes for the richer folks who inhabit the neighbourhood. The iron box they typically use is filled with and powered by burning coal. Needless to say, there are likely severe health implications for the person inhaling smoke from burning coal at an arm's distance for at least 8-10 hours on a daily basis. At some point, I asked the *Dhobi* in my street as to if he's ever sought getting an electric connection (which would not be a challenge by any means in terms of the hardware involved). He gave me a fairly despondent response saying that would be amazing, but why would the local RWA (Residents Welfare Association) bother with it?

It's been almost 8 years since that conversation. Every time I come across the matter of EVs and the massive concerns and efforts towards creating charging infrastructure, I cannot help reflecting on the privilege that cars enjoy in the modern era, and how deep the politics of mobility is entrenched within our society. It is likely that at some point in the (near) future the space all around his ironing set up will be populated with modern and costly charging stations for e-cars. And yet, he'll likely continue to press on with the coal-fuelled iron box (pun not intended). Or maybe, his decades long set up will have to eventually make way for one additional charging station and parking space.

Annexure 1: Template of interview questionnaire

- What would you say were the major factors that prompted the creation of policy frameworks for EVs in India around the turn of the last decade, such as the NMEM and NEMMP?
  a. How important was the Indian automotive sector's ambitions for EVs in this regard, such as Hero Electric (2W) that got set up in 2008 and Mahindra's acquisition of REVA in 2010? Was there any link to China's growing EV ambitions?
  b. Did India's energy security ambitions play a role in the formulation of these policies? How so? Was there any link between that and power sector and industries in India?
  c. Was India's climate change targets and commitments influential at the time?
  d. Did other international factors play a role, such as the IEA's Clean Energy Ministerial/ Electric Vehicles Initiative?
- What happened between the formulation of NMEM, NEMMP and FAME scheme? Was NMEM → NEMMP → FAME always the plan? What factors led to the launch of FAME?
  a. Did Indian automotive play any role in the formulation of shaping of the scheme and its priorities?
  b. Did India achieving power surplus in 2015 have any role, or in general India's energy security ambitions and power sector have any role in this?
  c. Did the Paris Agreement play any role in this, or in general India's climate commitments?
  d. Did other international factors play a role, such as the IEA's Clean Energy Ministerial/ Electric Vehicles Initiative, or China's growing EV ambitions?
  e. Did local issues like air pollution affect the creation of the scheme?
  f. How would you describe the evolution of FAME scheme from 2015 onwards, in terms of extensions, changes, the roll out of Phase II? What played a role in it?
- What do you make of future of EVs in India?
  a. What political economic factors could play a role in the future of EVs and how?

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