Stepping into the EV World: What is Preventing Pakistan's Sustainable Transition?

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CERTIFICATE

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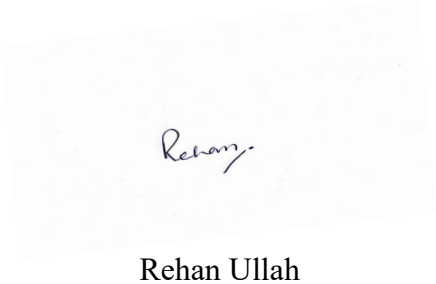

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Rehan Ullah

DEDICATION

This thesis is dedicated to my mother, Ms. Naheed Kausar, whose pursuit of learning amid the constraints she faced has been my first and finest lesson. Her quiet perseverance embodies the transformative promise of education and the hope it kindles. May her example continue to affirm that knowledge can uplift families and communities - even in the most adverse circumstances - and inspire future generations of scholars and leaders.

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ABSTRACT

The transport sector in Pakistan is highly dependent on imported oil and is a major contributor to air pollution. The adoption of electric vehicles (EVs) offers a viable solution to reduce emissions, improve urban air quality, and strengthen energy security. Despite these potential benefits, the rate of EV adoption remains significantly below the national target of 30 percent of new vehicles by 2030. This study investigates the underlying causes of Pakistan's slow EV transition using a qualitative methodology based on the Multi-Level Perspective (MLP) framework. Analysis of expert interviews and policy documents identifies barriers at multiple levels. At the macro level, economic challenges such as volatile fuel prices, currency instability, and reliance on a fossil-fuel-based power grid persist. At the meso level, institutional fragmentation, insufficient regulatory support, limited charging infrastructure, and resistance from the established automotive industry impede progress. At the micro level, high initial EV costs, restricted access to financing, low consumer awareness, and an underdeveloped domestic EV manufacturing sector present further obstacle. These challenges are mutually reinforcing, rendering incremental policy adjustments ineffective. As a result, current policies are inadequate, and the national EV targets are unlikely to be achieved without comprehensive systemic reforms. The study recommends the establishment of a central EV coordination authority to facilitate stakeholder alignment, rapid expansion of charging infrastructure alongside renewable energy integration, enhanced financial incentives and green financing mechanisms for EV purchases, and support for the development of the local EV industry. Implementing these coordinated, multi-level interventions is essential for Pakistan to realize its e-mobility goals and related climate and development targets.

Keywords: Electric Vehicles; Sustainable Transition; Multi-Level Perspective; Policy Barriers; Green Energy; E-Mobility Policy

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LIST OF ABBREVIATIONS

AIDEP	Auto Industry Development and Export Policy
BYD	Build Your Dreams (Chinese EV manufacturer)
CCS2	Combined Charging System 2
CNG	Compressed Natural Gas
EDB	Engineering Development Board
EV	Electric vehicle
GDP	Gross Domestic Product
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
JETP	Just Energy Transition Partnership
MLP	Multi-Level Perspective
NDC	Nationally Determined Contribution
NEV	National Electric Vehicle
NEVC	National Electric Vehicle Council
NEVP	National Electric Vehicle Policy
OECD	Organization for Economic Co-operation and Development
PIDE	Pakistan Institute of Development Economics
RQ1	Research Question 1
RQ2	Research Question 2
SBP	State Bank of Pakistan
TCO	Total Cost of Ownership
WHO	World Health Organization

Chapter 1:

Introduction

1.1 Background of Study

The global trend in low-carbon transportation has gained momentum over the last few years, and electric vehicles (EVs) have become the foundation of decarbonization agenda. By 2022, sales of EVs worldwide were more than 10 million vehicles, approximately 14 percent of total new automotive vehicles, compared to approximately 9 percent the previous year and just under 5 percent in 2020 (IEA, 2024). China has been leading this shift with an estimated 60% of the world EV cars being sold, but other nations such as India, Thailand, and Indonesia are also recording three times increase in EV sales in 2022 on a small base (IEA, 2024). These tendencies signify the falling prices of batteries and the favorable policies that have enabled the EVs to become more viable in mass adoption. Pakistan on the other hand has not adopted electrified transport easily. Domestic vehicle fleet is still too heavily reliant on internal combustion engines (ICEs), and EVs continue to represent a small portion of new vehicle sales. Contrary to this, Pakistan had previously moved to compressed natural gas (CNG) based engines for vehicles. The CNG transition was rapid since the necessary technological transformation was comparably incremental, conversion was inexpensive and refueling environment scaled fast in a conducive policy and investment environment. In comparison, EV adoption requires a more systemic change: low initial costs, new charging infrastructure, sufficient grid capacity, and robust long-term policy indicators. This renders EV diffusion a policy issue rather than a question of consumer preference and product supply since network externalities, coordination failures, and infrastructure of the good, mediate the results of adoption.

Such a sluggish adoption of EVs in the transport industry in Pakistan has a great environmental and economic impact. ICE based transportation (second largest source of carbon emission(Zia & Aslam, 2022)) have been a cause of ambient air pollution and carbon emissions in the urban areas; ambient air pollution is related to a high proportion of premature deaths and large economic costs, and vehicle emission is a significant proportion of fine particulate ($PM_{2.5}$/PM_{10}) in the large cities . Energy security is also compromised by the fact that we are still using fossil powered transport. Pakistan is forced to very high inventory levels of oil to power its vehicles, which is an extremely costly experience in the recent years, and it costs the national budget. As an example, the oil import bill of Pakistan rose by nearly USD 8.7 billion in 2021 to more than USD 17 billion in 2022, putting the economy at risk of global price volatility and foreign exchange risks (Zulfiqar & Farooq, 2024). Furthermore, the susceptibility to climate is severe: Pakistan is always ranked among the states that are the most susceptible to climate-related risks. The devastating floods that shook the country in 2022 displaced millions of individuals and caused about USD 30 billion in accumulated damages and losses related to the economy (World Bank, 2022), which exemplifies the severity of measures that mitigate the impact and enhance resilience. Collectively, these reasons demonstrate why increasing the pace of the shift towards cleaner mobility is not only an environmental issue, but also a strategic economic focus of Pakistan.

The use of electric vehicles can have several potential advantages in the Pakistani context. The EVs can transform the air quality in cities and save health expenditures on pollution because they will replace the petrol and the diesel engines. They can also enhance energy security by minimizing the use of imported fuel, moving a portion of transport energy requirements to locally generated electricity. Moreover, the transition to EVs will be in line with the international commitments of Pakistan on climate since they reduce the number of transport-related emissions. Seeing these

benefits, the Government of Pakistan introduced the National Electric Vehicle Policy (NEVP) in 2019 as a larger climate target. The NEVP had high goals, such as by 2030, 30 percent of new passenger vehicles will be sold as electric, and 90 percent by 2040 (and fiscal support to promote EV adoption) was offered (GOP, 2019). Among the main actions were EV tax cuts and the selection of charging equipment, as well as provisions that were designed to facilitate charging investments. Nevertheless, the adoption of the 2019 policy has been minimal, and the effect on the overall adoption of EVs has been small. Early measures like tax changes, pilot charging programs and the importation of a few EV products have created only slight market growth and EVs continue to represent less than one percent of new vehicle sales.

Meanwhile, the two-wheeler segment points out to an early bottom-up trend. The growing body of evidence on the use of electric motorcycles in Pakistan indicates that perceived value, operating-cost beliefs and pro-environmental attitudes may influence the intentions to adopt even in areas where the supporting policy and infrastructure may be insufficient. This trend also can be observed in the distributed solar market in Pakistan, whereby households and businesses have more recently installed roof mounted solar PV systems due to unstable grid supply and high-power prices, despite uncertain policies and irregular subsidies. Collectively, these tendencies indicate a significant difference to this study; consumer economics may stimulate local consumption changes, however, to make an EV conversion, particularly outside of two- and three-wheelers, require a concerted policy response, the infrastructure deployment, and institutional capability. Such disparity between proclaimed goals and measured results can therefore not be simply attributed to consumer preference and vehicle supply. EV diffusion has been extensively considered a market shaping policy issue where coordination limitations and externalities render believable long-term policy

indications, financing tools, and coordinated infrastructure deployment as primary determinants of adoption.

One of the main reasons is that the automotive and industrial ecosystem in Pakistan was not well prepared to allow an EV transition. Since decades, automotive policies stressed conventional assembly and localization of vehicles with great success, luring new ICE man factories under the Auto Development Policy of 2016-2021. These pro-ICE efforts increased the volume of local production and assembly of conventional cars but did not prepare the infrastructure to electrify its products. Until recently, domestic EV production facilities were virtually non-existent and charging facilities were few, grid planning to transport electrification was low and specific financing was available to EV purchasers. EV promotion-related institutional capacity and policy coordination were also interagency-dispersed before 2019. Pakistan in short was going into the EV transition with serious shortages in infrastructure, supply chains, money supply and governance systems that would be needed to aid diffusion. These gaps have limited the effect of the NEVP, giving the sense of a severe lack of connection between policy aspiration and the reality of EV implementation on the ground.

The underlying causes of the electric mobility paradox in Pakistan, which is high goals on paper and low ambitions of real practice, are analyzed through a socio-technical analytical framework in this study. The shift to EVs is viewed not as the implementation of new technologies in vehicles, but as a change systemic in its economic, technological, and institutional aspects (Geels, 2002). The evaluation examines the interplay of obstacles on various levels to impede the diffusion of EVs. Specifically, large initial expenses, lack of charging facilities, and substandard institutional coordination are interlocking barriers that strengthen incumbency organization. The most recent analyses of Pakistan also stress the role of limitations in EV rollout is not only affordability but

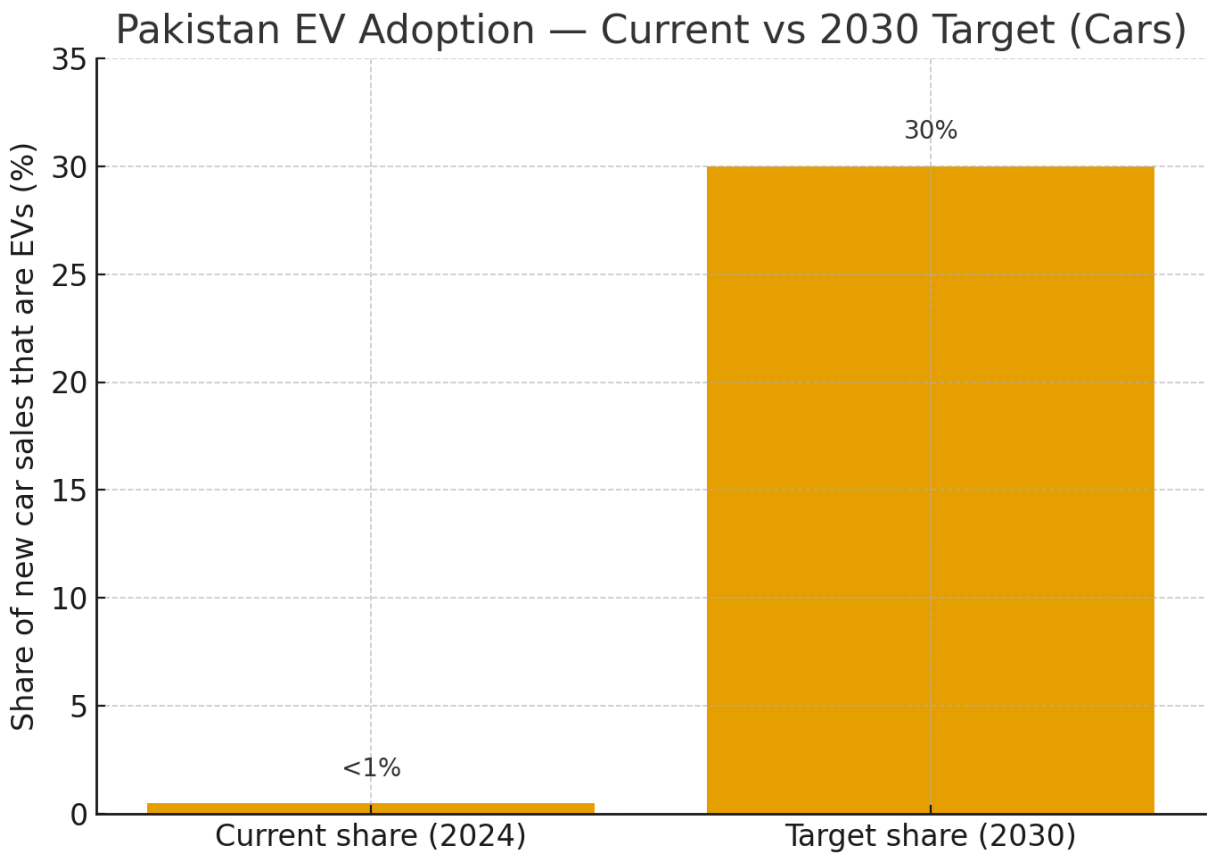
also lacks in electric vehicle charging networks, funding mechanisms, and institutional conformity (Asghar et al., 2021; Zulfiqar & Farooq, 2024). This study decomposes the interaction between these economic, infrastructural and governance forces that have conspired to drag the EV adoption at a slow pace in relation to the policy push, and why the actions that have been taken to date have been partial to alleviate these bottlenecks. The research identifies the different multi-level obstacles that hinder the process, a fact that forms a basis on how to narrow the implementation gap through specific interventions. Finally, an effective transition to electric mobility in Pakistan will need to be achieved by the joint efforts to harmonize the process of technological change with the growth of infrastructure and a well-developed policy and institutional framework.

1.2 Problem Statement

Although the National EV Policy 2019 set a target for 30 percent of new vehicles to be electric by 2030, and the NEV 2025–2030 draft framework has been introduced, Pakistan's EV adoption and charging infrastructure expansion remain significantly below these targets. This underperformance results from interconnected constraints at multiple levels: macro-level pressures such as volatile oil prices, foreign exchange instability, and an inadequate power grid; regime-level barriers including fragmented institutional mandates, inconsistent policies, and weak enforcement; and niche-level challenges such as high EV costs, limited financing options, and low consumer awareness. Existing policies only partially address these issues. A significant gap in the academic and policy literature contributes to this problem, as there has been limited analysis of how Pakistan's institutional context and multi-level barriers impede the EV transition. Most research on EV adoption centers on advanced economies, leaving Pakistan's specific governance, economic, and infrastructural challenges largely unexamined. This lack of context-specific

analysis obscures the reasons behind the limited effectiveness of current EV policies. The present study addresses this gap by applying a Multi-Level Perspective (MLP) framework to analyze the misalignment between Pakistan's EV policy objectives and actual outcomes. This approach clarifies why previous policy measures have produced limited results and identifies areas where institutional coordination, financial mechanisms, and regulatory sequencing require improvement. Defining this research problem contributes to the literature by advancing understanding of the EV transition in a developing-country context marked by fiscal constraints, energy system limitations, and governance complexities. By investigating the underlying causes of Pakistan's difficulties in electrifying transport, the study demonstrates the necessity for a nuanced, context-specific strategy. In summary, this research addresses not only the barriers to EV adoption in Pakistan but also the absence of an integrated analysis explaining the persistence of these barriers and the shortcomings of existing policy frameworks. This contribution is academically significant as it extends transition theory to a less-studied context and offers evidence-based recommendations for more effective policy interventions.

Fig 1.1: Pakistan EV Adoption – Current vs 2030 Target (Cars)



Reference: NEVP 2025-2030

1.3 Research Objectives

There are two main objectives of the study:

Obj 1: Identify the major barriers to EV adoption in Pakistan across different scales – landscape (macro: broad national and international factors), regime (meso: sector-specific structures and actors), and niche (micro: small innovative projects or startups).

Obj 2: Assess the weaknesses and gaps in Pakistan's current EV-related policies, and propose actionable policy recommendations to enable sustained, long-term e-mobility adoption.

1.4 Research Questions

RQ1: What are the major barriers preventing the widespread adoption of EVs in Pakistan, considering factors at the macro (landscape), meso (regime), and micro (niche) levels?

RQ2: What are the shortcomings in Pakistan's current EV policies, and how can future policy frameworks address these gaps to facilitate long-term sustainable adoption of EVs?

1.5 Significance of Research

This study contributes to the socio-technical transitions literature by applying the Multi-Level Perspective (MLP), a framework for analyzing system changes across landscape, regime, and niche levels, to a developing-country context. While most transition studies focus on Organisation for Economic Co-operation and Development (OECD) countries, this research examines how factors such as political instability, institutional fragmentation, and acute climate risk in Pakistan influence the dynamics of EV transition (Kotilainen et al., 2019). Mapping barriers at the landscape, regime, and niche levels will demonstrate how Pakistan's context diverges from typical cases, thereby enriching transition theory for emerging economies (IPCC, 2023; Zulfiqar & Farooq, 2024).

The findings will provide policymakers with a nuanced understanding of the shortcomings in current EV efforts. By identifying barriers at each level, such as high global oil prices (landscape), entrenched fuel subsidies and auto industry influence (regime), and nascent EV startups (niche), the study highlights opportunities for integrated policy approaches rather than isolated measures (Lebrouhi et al., 2021). The analysis will examine institutional coherence, with a focus on federal-provincial coordination and cross-sectoral alignment and will assess how these can be improved.

Additionally, the study will address just transition aspects, including the social equity implications of electrification, such as retraining workers and ensuring affordable financing for lower-income buyers, as well as the role of concessional finance, including international climate funds or Just Energy Transition Partnership (JETP)-like arrangements, in overcoming Pakistan's budget constraints (PIDE, 2023). These insights can inform the design of policy packages—regulations, subsidies, infrastructure investments, and communication strategies—that are coherent and tailored to Pakistan's institutional context (Zulfiqar & Farooq, 2024).

Promoting EV adoption in Pakistan aligns with multiple developmental objectives. It can improve air quality and public health in major cities, which is critical given the significant contribution of transport emissions to respiratory illnesses. Reducing oil imports would enhance economic stability and increase available foreign exchange for development (Adamashvili & Thrassou, 2024). Electrification of transportation would stimulate demand for renewable energy and support Pakistan's 2030 climate commitments, including a 60% renewable energy target and a 30% EV target (PIDE, 2023). A robust EV sector could also drive green industrial growth and job creation in vehicle assembly, battery manufacturing, and charging services. This development provides an inclusive pathway out of poverty for engineering and manufacturing workers. By emphasizing these co-benefits and the external costs of inaction, the study strengthens the case for integrated energy-transport policy approaches rather than isolated strategies (IPCC, 2023; Zulfiqar & Farooq, 2024).

1.6 Chapter Conclusion

The chapter proves the urgency of the need to electrify the transport sector in Pakistan as the number of climate-related disasters increases, air pollution is continuously high, and the country

must rely on the expensive imported fuel. Electric vehicles are a strategic solution, but they experience macro, miso and micro level barriers to implementation. This study is applicable to a socio-technical model to undertake a systematic analysis of these barriers as well as how they interrelate. The challenge is to make a connection between theoretical analysis and policy recommendations, based on evidence. The main plans would be to align the incentives with the development of the infrastructure, and marshal concessional finance suitable to the political and economic environment of Pakistan so that a practical transition to electric vehicles is made easier.

Chapter 2:

Theoretical Framework

2.1 Analytical Dimensions of the Multi-Level Perspective (MLP)

This research conducts a systematic review of the barriers and processes influencing the adoption of electric vehicles (EVs) in Pakistan, utilizing the Multi-Level Perspective (MLP) as its primary analytical framework. Socio-technical transitions, such as e-mobility, are perceived by the MLP, introduced by Geels (2002) and subsequently improved by (Markard et al., 2012) as a product of three levels of interaction: landscape, regime, and niches. These levels reflect both connected aspects of structure and agency, functioning at different time scales and having various stability and dynamism.

On the landscape level, the international oil costs, the global change of climate, geopolitical occurrences, demographic changes and cultural values affect the larger socio-technical mechanism to adopt EVs. Landscape pressures involve changing fuel prices which might make EVs more attractive, global climate agreements and domestic issues such as air pollution in cities and energy security, all of which make EVs a pressing concern. The changes in the landscape can be gradual due to such phenomena as climate change or urbanization, or they can be sudden as the critical innovations in battery technology.

The regime level refers to the current socio-technical order, which is marked by internal combustion engine motorized vehicles that use fossil fuel and the associated infrastructure and culture. This transport regime is institutionalized with all the stakeholders such as automakers, oil companies, government institutions, and consumers and the regulations that form the basis of the

interaction. Such innovations are often incremental, and changes instrumental to this level, including a move to EVs, are heavily resisted. Familiarity with the stability mechanisms of the regime such as laws, societal norms and cognition model of mobility is pertinent in supporting effective transitions.

The niche level is a shielded environment where radical innovations can be allowed to grow without any form of market pressure that helps in nurturing and experimenting the new technologies or practices. In Pakistan, there are niche operations such as the pilot project of electric buses in Karachi, the introduction of electric bikes by startups and scholarly research on EVs is an attempt to promote cleaner air and facilitate the transition to EVs. This tier acts as a change incubator, but most of the niche initiatives would fail. The discussion highlights the recent creative activities in the niches, the obstacles to their maturity, and the connection with the already established regime to reach the conclusion whether these niches may become mainstream-adopted.

2.2 MLP Interactions and Dynamics

In this research, it is a system review of factors and procedures involved in the adoption of electric cars in Pakistan that will be reviewed through Multi-Level Perspective. The MLP conceptual framework is a socio-technical shift, such as the shift to e-mobility, because the result of interactions in three planes landscape, regime, and niches (Geels, 2002; Markard et al., 2012). These are all forms of different but mutually dependent levels of structure and agency that operate at varying times scales, and which are dynamic and stable.

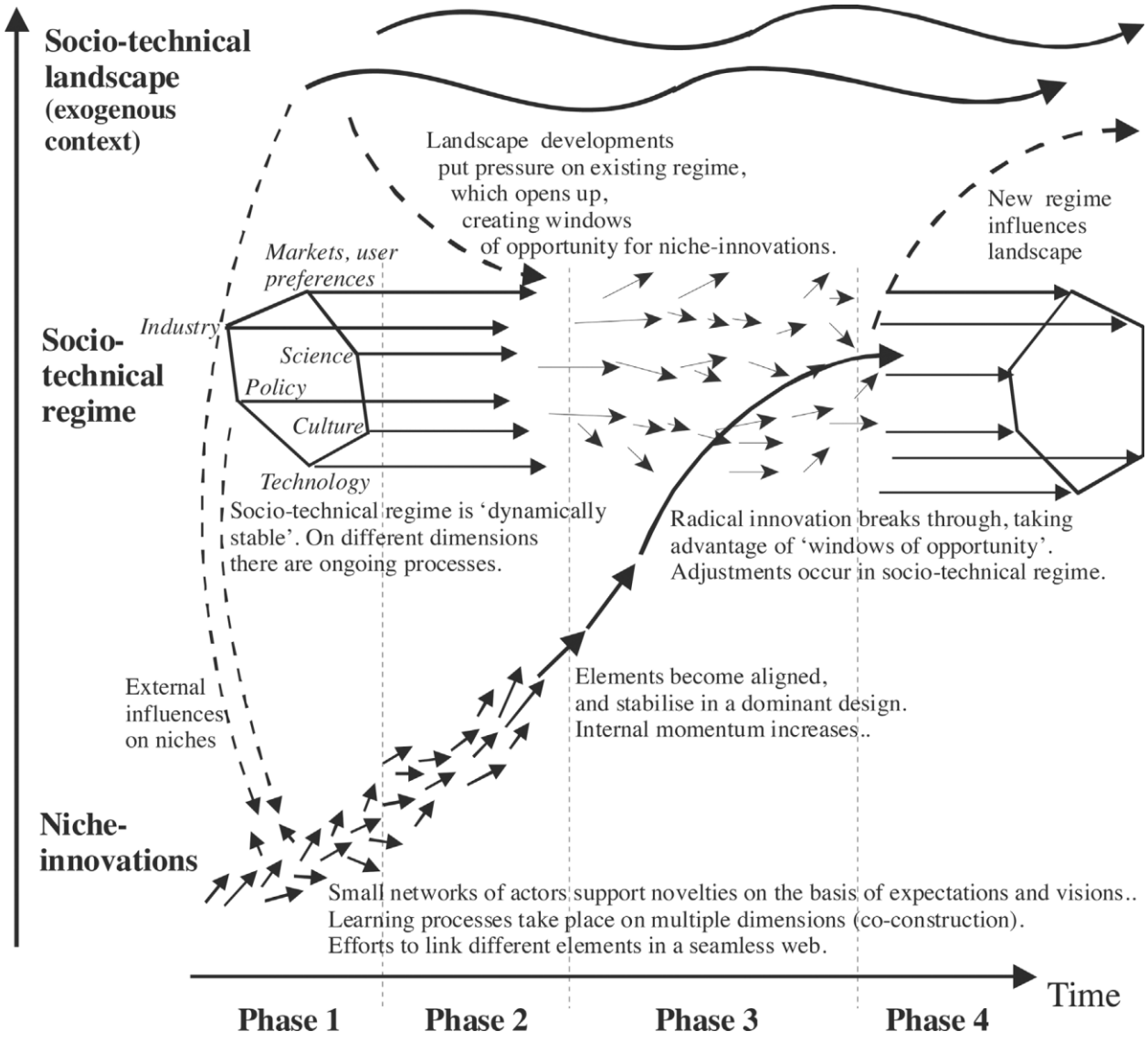
On a landscape level, international oil prices, the discourse of global climate change, geopolitical processes, population changes, and cultural values are the main factors that have a strong influence

on the socio-technical system. Such general pressures are beyond the ability of individual actors to manage but they provide room to change. The landscape pressures including changing oil prices, national climate negotiations, city air pollution crisis, and energy security issues in the context of EV transition in Pakistan play a significant role in influencing the national policy priorities. Alterations at this level may be either gradual (e.g. long-term climate change) or even disruptive (e.g. oil price spikes or battery breakthroughs). The regime level describes the current socio-technical systems which include technologies, infrastructures, policies, and market networks that already provide ICE vehicles. Regulatory, normative and cognitive systems stabilize these systems and maintain traditional mobility paradigms. Innovations at this level are usually incremental ones e.g. in engine efficiency or introducing compressed natural gas (CNG) vehicles. Some of the stakeholders that are important at the level are the automakers, oil companies, government agencies and consumers, all of which are connected by both formal and informal regulations.

The niche level can act as a breeding ground of radical innovations that can survive outside the mainstream market pressures. They involve efforts such as electric vehicle projects, pilot initiatives and community-based efforts and these might be funded or supported by policy. Although most of the niche activities lack the ability to scale, others might produce other innovations that will become scalable on a global scale. The research discusses different niche-oriented activity that has impacted the adoption of EVs in Pakistan, including pilot programs of electric buses in Karachi, the development of electric bike startups, scholarly literature on the topic of electric vehicles, and activism on cleaner air.

The analysis will focus on the prospects for these niches to gain momentum and potentially transition into mainstream acceptance while also identifying barriers to their advancement within the regime.

Fig 2.1: Multi-level perspective on sociotechnical transitions.



Reference: Frank W. Geels 2018

2.3 Application to Pakistan's Context:

In Pakistan, the use of the MLP would require alteration of the structure to suit the local circumstances. The transition in Pakistan can take an alternative course as it is unique to the situation. By way of example, the acute pressures associated with the landscape in Pakistan are

macroeconomic crisis and political instability that are not so highlighted in classic MLP case studies that are considered in well-established European nations. A regime is characterized not only by technological and market lock-ins but also by governance issues and deficit of capacity. Accordingly, MLP is used as an empirical means to structure qualitative data on barriers and drivers and not as a hard predictive model. The levels of analysis, i.e.: macro, meso, and micro, are associated with certain parts of the research results and literature review so that a sensible theoretical framework is guaranteed. As an example, global fuel prices and cultural norms are landscape pressures in the MLP which can be associated with macro-level barriers identified in the literature review. Meso-levels of obstacles resonate with the regime lock-ins, such as the industry structure, policies, and institutional fragmentation. Micro-level barriers are related to niche processes, including the lack of innovation support and consumer behavior issues. With empirical observations, it is possible to map data to the MLP structure and find the lack of alignment and alignment between levels. To take the example, when there is a high landscape pressure like international climate commitments, but the regime is not changed, this is usually a signal of countervailing regime power or niche weakness. If the niches are present and not growing, like e-mobility startups, the analysis would be to determine whether the regime or landscape conditions are harmful, which may include things like the lack of subsidies or the continuity of low fuel prices. The MLP framework can therefore be used to study multi-level alignment since successful transitions normally demand alignment of the landscape, regime, and the niche factor to favor the new technology. It is also analyzed based on the concept of windows of opportunity (Geels, 2002), which are the instances when the circumstances are favorable to allow the change to take place faster. To illustrate, the rise of oil prices in the world market in 2018 could have been used as a promotional tool to sell EVs as a source of fuel security. On the same note, the introduction of the

National Electric Vehicle Policy (NEVP) in 2019 offered a chance to local niche innovations to prepare to take advantage of favorable policy provisions. Other opportunities can be offered through the presence of international climate funds to support EV projects or regional momentum due to EV success of a neighboring country. The MLP framework identifies the significance of timing and alignment which helps in identifying the moment and the way through multi-level dynamics can open channels of transition.

2.4 Theoretical Synthesis

The use of the Multi-Level Perspective (MLP) in the research aims not only to narrate the stalled transition of Pakistan to electric vehicles (EV) but also to add to the theory by determining the applicability limits and possible extensions of the framework to a developing-country scenario. The main observations that were made during this synthesis are:

Governance Capacity Matters: The discussion reveals that in the absence of a governance effectiveness threshold, any transitions may stagnate regardless of whether the landscape and niche conditions are favorable. The implication of this observation is that transition models might have to explicitly specify the quality of governance, including institutional coordination and policy continuity, as a condition to regime change.

Culture and Informality in Transitions: It is important in the situation in Pakistan that culture narratives and informal economy play an important role. The longer MLP model could consider cultural acceptance and informal-sector innovations as within the niche dynamics, and not as exogenous influences, since grassroots adaptations (such as retrofitting gasoline motorcycles to electric in local workshops) can be a pointer and influence subsequent transition pathways.

Landscape Pressures as International Influences: The external forces that impact on what is possible and cannot be done in Pakistan as landscape pressures are the donor-based programs, international trade patterns and international technological trends. It is observed that these global forces may accelerate or decelerate transitions. As an example, the dependence on the foreign electric vehicle (EV) technology will lead to vulnerability and channels of rapid transfer of technology.

The MLP offers a systematic tool to the analysis of multidimensional issues of EV adoption in Pakistan, which will see to it that the further research is based on a framework that will allow managing complexity and providing effective interventions. The literature review and the empirical analysis will be based on this conceptual underpinning.

Chapter: 3

Literature Review

3.1 Introduction

EVs are becoming some of the most important elements of the transition to low carbon, mainly because of their lower tailpipe emissions, less dependence on oil, and possible improvement of the quality of urban air (Sadiq Jajja et al., 2021). The EV sales in the world have increased significantly over the last ten years. As an example, the global EV fleet has grown by about 5 million vehicles in 2018, which is 64 percent of the growth rate (Asghar et al., 2021). Still, the adoption is not even all over. The most substantial growth has been witnessed in the advanced economies, and this is highly due to proactive policies and market incentives. On the other hand, EVs give developing nations a chance to escape transport systems that are highly polluted. Being listed among the most climate-vulnerable countries, Pakistan is the country with acute transport-sector emissions and serious urban smog (Asghar et al., 2021; Sadiq Jajja et al., 2021). Road transport contributes to almost a fifth of the carbon emissions in Pakistan and the result of air pollution is hundreds of thousands of deaths per year. The Pakistani government, in turn, has also proposed ambitious EV adoption goals, in which they want to electrify 90 percent of vehicles by 2040 (NEVP 2025-2030) as a part of a wider electrification plan. To reach these targets, it is important that deep-rooted economic, technical and social obstacles are tackled. Past surveys have shown that ICE vehicles in the developing world create serious externalities, such as both negative health outcomes and security hazards, social expenses and not personal ones (Kumar & Alok, 2020). Even though EVs have the potential to alleviate most of these external costs, the realization of this potential is conditional upon the creation and introduction of favorable institutional and infrastructural

systems. This chapter places the EV transition in Pakistan in the general social-technical context, theorizing it as a niche innovation that aims to challenge the automobile status quo in the context of changing climatic, political and technological pressures. This analysis will rely on the existing transition theories, such as the Multi-Level Perspective, the policy mix analysis and the political economy, and empirical research to examine EV adoption, barriers and policy lessons in the world and in emerging economies. The conceptual factors (externalities, learning curves, and lock-in effects, network externalities, and just-transition issues) are outlined to describe why EV adoption persistently remains a problem without a strong policy effort. The literature review includes the evolution of the theoretical frameworks, the main ideas, searches evidence on the topic around the world and in Pakistan and summarizes its implications along with the views of government, industry, and academia. It ends with the definition of research gaps and the guidance of thesis design.

3.2 Theoretical Lenses

There are a number of interlocking frameworks used to structure the analysis in this thesis. First, the Multi-Level Perspective (MLP) considers EVs as a nascent niche that competes in the established regime in the automotive industry, which is placed in a wider context of economic and social forces (Fichter & Clausen, 2021). MLP emphasizes the role of path-dependent legacies (e.g., gasoline infrastructure, regulatory standards, consumer habits) that generate lock-in to conventional vehicles, and how there can be windows of opportunity (e.g. climate commitments) that would allow niche innovations like EVs to enter the market. Notably, MLP highlights the co-evolution of technology, user practices, and institutions, which implies that a sustainable EV shift needs coordination between niche innovations, regime actors, and landscape pressures (Fichter &

Clausen, 2021). This framework is directly related to the application of policy and institutional strategies of encouraging EV transitions, which are addressed next.

Second, there are policy mix and implementation theories that highlight the inadequacy of any one policy. Governments need to implement coordinated combinations of financial systems, policies, and information controls. As an example, an examination of an EV policy mix in China identifies a rare group of interactive state actors that were a key factor in the coordination and mobilization of system resources. Changes in socio-technical conditions bring in new actors (Song et al., 2023). This implies that an ever-changing system of ministries, agencies, groups of industry, to administer subsidies, regulations, standards, and infrastructure will also be required in Pakistan. This is a theme that will be explored later. The ability of the state to enforce and implement these measures of the policy mix is critical to policy effectiveness. Even well-intended EV policy incentives can be sabotaged by a lack of administrative capacity (or coordination) in many emerging environments.

The third analysis method is the political economy perspective, which investigates how the current industries and interest groups affected the EV transition. The well-established car producers are often the ones who oppose change by lobbying and are likely to embrace the transitions when they can see distinct advantages. On the same note, nations, which export fuel or rely so much on coal, might act against EVs development. Poverty, inequality and fragmented institutions in developing economies may lead to EV policies that prefer the richer segments of society unless the policy is designed to mitigate such imbalances. On a fair position, the just transition approach centers on fair sharing of costs as well as benefits. The policies should make sure that the low-income

population and those workers who may lose their jobs due to the process of electrification can share the benefits do not suffer negative impacts (Kumar & Alok, 2020).

Theory of Planned Behavior is an example of acceptance and behavior theories that examine factors that affect consumer decisions to purchase EVs. Purchase cost, driving range, availability of charging infrastructure and personal attitudes are always found to be important determinants by the surveys. Indeed, when a planned-behavior framework was utilized in a study within Beijing, they discovered that the positive attitude, the perceived behavioral control, and, to a greater degree, monetary incentives can substantially boost purchase intention, whereas social norms had a lesser effect (Huang & Ge, 2019). Specifically, according to initial studies in the Pakistani setting, expensive buying prices and insufficient charging stations are the key obstacles to the EV uptake (Javid et al., 2022). These micro-level determinants must eventually correlate with the macro-level policies so that long-term diffusion can take place. To conclude, a detailed overview of the EV transition in Pakistan is impossible without the concomitant inclusion of structural lock-ins, the combination of policies, distributional politics, and consumer psychology.

3.3 Core Concepts & Definitions

The body of literature about the transition to electric vehicles (EVs) points to several crucial concepts, which shape the implications of the shift in question. One of the main principles is the concept of externalities, or the costs or benefits related to the usage of a vehicle but not captured in the market prices. Conventional fossil-powered automobiles are known to have major adverse externalities, air and noise pollution, and greenhouse gas (GHG) emissions. Conversely, EVs offer an opportunity with a possibility of zero tailpipe emissions but their total environmental impact depends on the source of electricity and the total lifecycle of the vehicles. It has been claimed in

some studies that EVs can result in a decline of GHG emissions and air quality but it is important to remember that unless the power sector is decarbonized, pollution can be redirected towards the emissions of power plants. Therefore, the focus on the externalities of transportation helps to emphasize the importance of proactive EV policies.

The other important concept is the Total Cost of Ownership (TCO) which is the sum of all costs involved in the life cycle of a vehicle and it includes purchase price, fuel/energy and maintenance costs. Although the initial cost of EVs can be expected to be more expensive, it can be very cost-effective in terms of the cost of operation. Some of these models indicate that the homeowners who can charge their EV at home are likely to have a reduced TCO than ICE vehicles. However, studies show that in most of their emerging markets the net ownership cost of EVs is still relatively high in comparison to conventional hybrids or ICE vehicles because of the cost difference in batteries and the components.

The concept of cumulative production and learning curves explains that the higher the experience with EVs, particularly in terms of battery technology, the lower the costs of the EV components are bound to be in the long run. Majority of the experts believe that innovations and economies of scale will cause less prices in the long run. Moreover, network effects are an important factor in the EV market, as the larger the charging infrastructure the more valuable the possession of an EV is and vice versa more EVs can be used to invest in charging infrastructure. This self-reinforcing dynamics of innovation diffusion can be observed in this interdependence, which is the transition theory, discussed by Geels.

The idea of lock-in or path dependence depends on the way decisions made at an early stage on the technological and infrastructural level may restrict further options. Implementing alternative technologies is expensive when some types of vehicles or sources of fuel prevail in the market.

According to the literature, there are different lock-in aspects that are related to past industrial choices, and the aspects can keep the outdated technologies alive. Policy interventions are frequently required to overcome such entrenchments which encourages a critical mass of EVs in a mainstream setting irrespective of the complexity of such regulatory changes. This discussion is connected with the principle of just transition which suggests adoption of fair methods of the decarbonization process to make sure that the benefits, including air quality improvements and creation of new jobs in new industries, are distributed widely, especially among poorer populations and workers who have been displaced due to the fall of old industries. Lack of policy formulation in such countries as Pakistan that is not aimed at solving social inequalities may lead to reinforcement of the already existing disparities. Some of the proposed solutions to facilitate this transition are subsidies of low-income purchasers and retraining of workers.

3.4 Global Evidence

The EV market is expanding globally and is still concentrated in several countries. These are Norway, China, the US and the EU states. In Norway, EVs recently took up most of new car's sales. This was affected by a lot of incentives. Conversely, developing countries in Asia, Africa and Latin America record lower adoption. Researchers have reported that the rate of EV adoption is higher in developed nations as compared to developing nations (Babar & Ali, 2021; Rajper & Albrecht, 2020). Some of the factors mentioned to cause this imbalance include cost and infrastructure challenges. One intercountry study names the sticker price as one of the major constraints. Indicatively, one of the U.S. studies observes that EVs are on average priced at $18,000-70,000 higher than ICE vehicles (Rajper & Albrecht, 2020). Consumer means and incentive programs tend to alleviate this gap in wealthier countries. Other analyses conducted in

the world show that the sales of the EVs will gradually rise when the renewable energy sources as well as the charging infrastructure will be more accessible. They are likely to be low in areas where there is low grid reliability. To give some examples, (Schroeder & Traber, 2012) suggest that in Germany 1000 public fast chargers business model was not profitable at low rates of EV adoption provided the cost of investment was reduced significantly. These results indicate that the EV adoption can require a specific point at which the large-scale fast-charging network could be functional.

Such trends portray the energy and transportation systems at large. It is hardly the case that the transport in most countries is fully electrified: in China, the country where the number of EVs is the highest, still a slight portion of the total vehicle fleet is occupied by electric cars. However, the experience of China shows how industrial policy and specific incentives can be used to achieve fast growth: according to one of the reviews, China has integrated subsidies, infrastructure investment and promotion of manufacturing into a multifaceted and dynamic policy (Song et al., 2023). Surveys in urban hubs such as Beijing reveal that consumers are appreciating the traditional vehicle specifications (range, price, brand) but are also starting to consider EV-related features and benefits. This is supported by a study in Beijing that revealed that positive attitudes towards technology and monetary stimuli are the major drivers of their intention to purchase EVs (Huang & Ge, 2019). Nevertheless, in that case non-monetary benefits (e.g. license exemption) were of less influence, Huang thinks, which points to financial cost as the prevailing element in most markets. In general, the international experience indicates that the EV diffusion is an S-curve: following the first niche (when the early adopters in green- or tech-conscious markets are involved), the recent adoption may grow exponentially when the socio-technical factors (policy,

culture, and economy) are in place. Having these international trends put in place, the review goes ahead to discuss how these lessons can be applied to emerging markets, but in this case Pakistan.

3.5 Emerging and Developing Contexts

Emerging economies and developing countries have unique challenges to the EV transition, such as the outdated vehicle stock, the lack of regulatory capacity, and inadequacies in the charging infrastructure. A closer look at Asia and Africa reveals acute infrastructure deficiencies: most cities do not have reliable power sources and a high number of charging stations, which leads to charging anxiety in prospective customers (Rajper & Albrecht, 2020). There is also a lack of charging infrastructure and common power outages in Pakistan, which discourages the use of EVs (Javid et al., 2022; Rajper & Albrecht, 2020). Studies of Bangladesh conclude that grids are not reliable and there are no charging stations at the house, which makes EVs significantly less convenient than hybrids (Babar & Ali, 2021; Rajper & Albrecht, 2020).

The primary issue is cost barriers and affordability: the prices of EVs are particularly prohibitive in the countries with a low level of income, and research reports that they cost more to own altogether than gasoline or hybrids do in the upcoming markets (Babar & Ali, 2021). Market price, technical issues, and small subsidies provided by the state are the main barriers in entering EV markets in Pakistan (Javid et al., 2022). The high capital requirements lock out a great number of consumers, and big informal or used-car markets make it hard to switch to cleaner technologies.

Electric vehicle (EV) development is hindered by institutional and knowledge gaps in large proportion. It has been found out that the stakeholders in developing nations are not always knowledgeable in the production, maintenance, and regulations of EV. The battery EV

manufacturing value chain in Pakistan is still immature and needs to be developed to a large capacity (Sadiq Jajja et al., 2021). Mobilization process of the local companies, local supply chains, and local networks of innovation is not well comprehended in these environments. There are also problems with policy making and these include ineffective incentive plans and lack of inter ministerial coordination. There are also different influences of social factors. As an illustration, the range constraints would be reduced in cities where there is a short distance to travel than in the rural areas where there are no fueling stations to service the vehicles which keeps the society dependent on the old engines.

Some of the emerging economies are on the way to the electric vehicle (EV) implementation despite major challenges. Brazil, India, and Thailand, among other countries, have set up staged EV goals, often focusing on the use of electric two and three-wheelers. These markets have a smooth and uneven adoption pattern. As an example, electric rickshaws are already spreading in the most polluted cities of Bangladesh and Indonesia, but the adoption of passenger EVs is still low (Babar & Ali, 2021). The first step to decarbonization can be hybrid cars, which require fewer infrastructures. There is evidence that the shift toward hybrids has the potential to decrease the reliance on standard vehicles in developing countries (Babar & Ali, 2021). In general, the literature shows that development settings need tailor-made transition strategies, e.g., the use of transitional technologies and specific incentives, instead of copying the practices of Organization for Economic Co-operation and Development (OECD) countries.

3.6 Pakistan-Relevant Synthesis

The case of the Multi-Level Perspective (MLP) and Government-Industry-Academia (GIA) model applied to the Pakistani context reveals that there are several essential elements that affect the shift to the use of electric vehicles (EVs). Pakistan has a considerable landscape pressure, such as a dire climate vulnerability, a high level of fossil fuel imports, and a long-standing air quality problem that has developed a national incentive to use EVs at the governmental level. The Government of Pakistan (GOP) has included EVs into one of its national priorities and expects 90 percent of all vehicles to be electric by 2040. Although this is the goal, the mainstream adoption is impeded by structural challenges, including insufficient capital and conflicting development agendas, which leaves EVs in the voluntary niche instead of an omnipresent solution (Asghar et al., 2021; Sadiq Jajja et al., 2021).

At the regime level, there is a strong influence of the current industry and institutional dynamics in the EV landscape. Pakistan has a low EV potential in value of its local automotive industry with most of the automobiles being imported or assembled out of complete knockdown (CKD) kits. To achieve successful transition, the company requires improvements in technological and organizational capacities across the EV value chain, which Pakistani companies are not ready to do at the moment. Consumer sensitivity of price also adds a further complication to demand resulting in government proposals of holidays and subsidies in the market to improve the market. Any financial incentives, however, must be tuned to success by making sure that they are effective in alleviating the price gap and combined with the promotion of charging infrastructure.

The transport, energy, and finance sectors should be coordinated to successfully transition to EVs, which is demonstrated by Chinese experience (Song et al., 2023). Alas though, the institutions in

Pakistan have failed to clarify the role they play which could lead to a gap or overlap in the implementation of policies. At the niche level, one should not disregard the role of research and development (R&D); the current activities in the sphere of EV technology and consumer perceptions in Pakistani academic circles are still in their infancy, and one cannot find domestic research and development in relation to batteries and testing facilities. In most cases, the amount of social science research on EV acceptance is still in its early stages, whereas technical R&D is not doing well (Javid et al., 2022).

The GIA framework incorporates these observations to identify opportunities and challenges to the EV transition of Pakistan. Despite the policies and international funding of sustainable transport being initiated by the government, there is a question about the implementation of these policies. Constant policy alteration which is close to the Chinese model is essential in successful transition. Although the local auto parts manufacturing industry has an interest and potential in entrepreneurship to convert the industry to EV components, it is challenged with international competition. Schools can contribute to the research on EV grid integration and monetary models, which will benefit both the government and the industry, only after they obtain the right knowledge (Song et al., 2023).

In general, the literature on EV situation in Pakistan agrees on some of the discouraging factors, including elevated costs and the lack of sufficient infrastructure to encourage consumers to buy. Potential possibility exists of a higher level of consumer acceptance due to lower fuel prices and consideration of the environment, but only in case of overcoming the current barriers. The NEV Policy suggested by the GOP in 2025-30 has a range of incentives yet does not include an extensive implementation strategy. Pakistan is indicative of a trend in global emerging markets of dynamic emerging markets experiencing overwhelming demands to change, but without a ready regime and

a weak niche. Major unaddressed challenges include the sequencing of reforms, mobilization of stakeholders to triumph over the transition to EVs (Javid et al., 2022).

3.7 Adoption of New Technologies in Pakistan under Socio-Technical Constraints

Despite economic and infrastructural constraints, Pakistan has recently seen the niche uptake of electric bikes and e-rickshaws through an uneven socio-technical process. Electric bikes have grown in 2024 especially with approximately 50,000 electric scooters manufactured and sold in FY2023-24 (as compared to about 15,000 in the previous year) (KHAN, 2025). Electric rickshaws too have emerged as cheap city substitutes. Nevertheless, adoption is still limited: EV two-wheelers are said to be approximately 40% higher in price than petrol and therefore the upfront price and affordability limits still influence the micro level of diffusion.

The previous technology take-ups in Pakistan demonstrate how even in the presence of macro-, meso-, and micro-level barriers, diffusion can take place. The CNG switch was growing at a high pace in the 2000s; approximately 2.5 million CNG vehicles existed in Pakistan (approximately a fifth of the vehicles) by 2011 thanks to incentives on costs and a surge in the number of stations (Dawn, 2011). More recently, rooftop solar has been diffused by private ventures as a result of the unreliability of electricity provision and high tariffs. (World Economic Forum, 2024) reported that solar module imports have increased in 2024, and Pakistan has turned out to be an emerging solar market with little political backing. The same can be said of the growth of ICTs: the faster growth came with the emergence of relatively cheap devices and services even in the face of institutional and infrastructure divides.

Such instances highlight a socio-technical trend: adoption rates are likely to increase when landscape conditions render the status quo expensive and alternatives are available. This can be

described as multi-level perspective (MLP) and discussed at landscape level, regime level and niche level (Geels, 2002). In the case of electric mobility, it remains apparent that obstacles on all three levels include fuel-price and electricity-system pressures affecting interest and charging anxiety; regime-level discontinuities and poor coordination have slowed the process; and niche-level barriers include insufficient local capacity and consumer cost-related skepticism. Nonetheless, they are being adopted through experimentation: by 2025, the government counted approximately 70,000 electric two-wheelers on the road, as well as an increase in domestic assemblers/startups and a policy shift towards large subsidies on 2- and 3-wheelers (Arab News, 2025). The emergence of e-bikes and e-rickshaws-read together with the CNG, diffusion of solar, and ICT in Pakistan supports the view that the adoption of technology in the country should be thought of as a systemic change that occurs in response to interacting pressures, institutions, and incentives at the user level.

3.8 Summary of Pakistan's Automotive Policy Evolution:

The automotive policy of Pakistan has evolved through the import-substitution policy adopted during the initial years of the post-independence regime to liberal and investment-oriented policies in the 2010s. The 1950-1980s policies focused on domestic parts production through encouragement of local assemblies and deletions efforts; however, the strategies proved to be rather ineffective. Tariff-based regimes that were established as a result of compliance with World Trade Organization (WTO) agreements in the mid-2000s minimized localization requirements at a gradual pace. Automobile Development Policy 2016-2021 was a major change since it provided tax incentives to new players whether entering through a greenfield or brownfield, and it also increased standards in the industry. This policy led to the creation of around 21 new assembly

licenses and more than US$1 billion of investments commitment proving that even the traditional automotive industry can be increased through pro-competition policies. Previous policies have not given priority to electric vehicles (EVs). In 2019, a new policy named National Electric Vehicle Policy (NEVP) was passed with new ambitious goals and incentives. NEVP 2019 set targets of penetration of different vehicle segments including 30 percent of new cars and 50 percent of the two and three wheelers by 2030. It also imposed a 1% sales tax on EVs instead of 17 percent on ICE vehicles and decreased duty on charging equipment. The policy introduced inter-ministerial committee and EV model cities, which indicated a high level of government investment in EV adoption. Though such measures have been put in place, there is still a gap between policy making and implementation. The policy on EVs of 2019 had ambitious targets that were not backed by strong implementation means. Some of the major weaknesses that have been established by various analyses are the lack of a central coordinating body, insufficient technical standards, and absence of a specific rollout strategy on charging infrastructure. The legacies of the past, including the existing protectionist tariff system and the lack of research and development (R&D) investment, have led to a lack of domestic EV competence, and the industry is largely dependent on the importation or the use of knock-down kits. In short, although the policy trend of the automotive in Pakistan has established a platform based on which EV transition can be made, it has not entirely equipped the nation to adopt it massively. The Ministry of Industries has developed the draft National Electric Vehicle (NEV) Policy 2025-2030 that aims at mitigating these shortcomings by outlining concepts of institutionalization and targeted infrastructure. This thesis puts the results of the EV policy in Pakistan in the context of the past policy choices and institutional limitations, whereby the system needs systematic reforms, rather than a new policy program.

Table 3.1: Pakistan Auto Policies Overview since 1947

Years/ Period	Policy / Program	Type	Major themes (summarized)	What was achieved / outcomes (as evidenced)
1949–1971	Early assembly & import-substitution regime (initial plants, CKD assembly)	Auto	Establish basic assembly; import-substitution; limited vendor base; state guidance evolving	First auto plant set up in May 1949; early assembly expanded but localization and capability growth remained limited due to weak ancillary industries and management capacity.
1972–early 1980s	Nationalization & sector reorganization (Economic Reform Order 1972)	Auto	Public ownership; creation of state corporations; central coordination via Board of Industrial Management	Units nationalized; corporations created to steer industrial policy, though execution commitment and performance were uneven.
mid-1980s–2004	Vendor Development / "Deletion" (Localization) Program	Auto	Compulsory localization thresholds; indigenization; vendor industry growth	Localization policy formalized (1987–2004); deletion levels documented across models (e.g., 58–68% for key car models), fostering a domestic parts base.
2006 →	Tariff-Based System (TBS) replacing Deletion Program	Auto	WTO-TRIMs compliance; SRO-based tariff structure; CKD facilitation	Deletion program replaced by TBS; SRO 656/655/693 (2006) structured CKD concessions, localized-parts duty, and vendor input regimes to align with TRIMs.
2007–2012	Auto Industry Development Programme (AIDP)	Auto	5-year tariff plan; investment/technology/HRD/cluster schemes; AIDC	AIDP announced (Nov 13, 2007) with multi-pillar support; implementation was partial amid recession; car output fell sharply in 2008–09; limited new entry (e.g., Al-Haj FAW in 2011).

2016–2021	Automotive Development Policy (ADP 2016–21)	Auto	New-entrant (greenfield/brownfield) incentives; safety/standards; consumer welfare; AIDC reform	21 greenfield statuses granted; multiple new makes introduced; >US$1 billion committed; seven car/LCV/SUV manufacturers issued certificates—enhancing competition.
2019	National Electric Vehicle Policy (NEVP 2019)	EV	Penetration targets; incentives by segment; charging ecosystem; inter-ministerial committee; model cities; SEZ linkages	Government approved minimum EV penetration targets; detailed incentive menus for 2–3 wheelers, cars, buses, trucks; roles defined for federal/provincial bodies; Lahore/Islamabad designated model cities.
2020–2025	Electric Vehicle & New Technology Policy (MoIP/EDB)	EV (with hybrids/new tech)	Integrate EVs with ADP regime; phased transition; segment-specific tariff incentives; AIDC consultations	Scope covers 2/3-wheelers, 4-wheelers, LCV/HCV; lays out tariff incentives (e.g., 1% CD for select charger modules/EV parts); aligns with ADP 2016–21 to enable local assembly/manufacture.
2021–2026	Auto Industry Development & Export Policy (AIDEP 2021–26)	Auto (+ enabling for new tech)	Export orientation; supply-chain deepening; WP-29 vehicle safety adoption; AIDEC oversight	Cabinet-approved follow-on to ADP; plan to implement UN WP-29 safety regulations; continued rationalization and export push; formal monitoring via AIDEC.
Effective 2022 (phased)	UN WP-29 Regulations adoption (vehicle safety, standards)	Auto (cross-cutting)	Harmonization with UNECE regulations; conformity & market access	Pakistan acceded to WP-29; phased adoption of priority regulations started July 1, 2022, supporting quality/safety and facilitating trade.
2024–2025	New Energy Vehicle (NEV) Policy 2025–2030 (announced)	EV	30% EV target by 2030; broadened EV transition agenda; charging/standards emphasis	Government announced NEV 2025–30 framework with 30% share target by 2030.

Reference: Authors own categorization from online sources.

3.9 Synthesis and Gaps

There is an obvious agreement in the literature on most aspects: EVs can provide environmental and energy security (Kumar & Alok, 2020; Sadiq Jajja et al., 2021), but the use of EVs is hindered by technological lock-ins, high costs, and institutional inertia. Ratings point to similar barriers many times such as high purchasing costs, insufficient charging opportunities, and the lack of knowledge among the consumers (Babar & Ali, 2021; Javid et al., 2022; Rajper & Albrecht, 2020). They also highlight the conditions of enabling: aggressive support of the policy, modernization of the grid, and better quality of a vehicle. These international observations in the Pakistan context are repaying with the scanty local research. Scientists agree that to be in the footsteps of the developed nations, Pakistan needs to focus on the entire innovation chain, including the production ability and financing consumer sectors.

Nevertheless, there are still some critical points. First, it is context specific: the majority of EV research is based in Europe, China, or the U.S., with very few publications on Pakistan or other economy-based countries. Although this research relies on the generic transition theory and the example of Pakistan when studied in isolation, it is lacking in scholarly literature that takes a more in-depth approach to explaining the specifics of political economic and cultural conditions in the EV narrative in Pakistan. As an example, to what extent will subsidy system, federal-provincial relations or automotive trade policies in Pakistan influence results? Literature does not answer such questions.

Second, gaps in policy implementation can be observed. The example of the EV policy mix in China proves that the analysis and mapping of interacting governance entities are possible (Song et al., 2023); in the case of Pakistan, there is no such analysis. Given the EV transitions, the literature recommends that further studies are done on the administration of policy mixes. Research on the bureaucratic networks in Pakistan and how they can be transformed to handle the EV push would be beneficial to Pakistan.

Third, little literature specifically considers socioeconomic impacts, including equity or land-use impacts. An example is that of the transition and environmental justice, which are highly vital in the discourse of inclusive development and are largely missing. Similarly, although the quality of air in urban areas is mentioned as a driving factor, there are limited studies on the way the EV adoption would change the shape of the traffic, grid loading, or the city layout of Pakistani cities.

Fourth, the field has a methodological gap: empirical EV studies in Pakistan are usually initial (e.g., small-surveys, concept tests) but not massive-modeling or pilot projects. The impact of EVs or scenario analysis is virtually missing in the case of Pakistan.

Evidently, the literature indicates that EVs will benefit Pakistan but require tangible action that has been researched. The absence of both integrated and Pakistan-specific studies and discussion on the policy implementation demonstrates the apparent gaps in research. These gaps in knowledge would need high-quality analyses such as those referenced in the case of China and Bangladesh.

3.10 Implications for Research Questions and Thesis Design

Our research questions and this thesis design are informed by the review. To begin with, the policy mix literatures and the MLP theories point to the issues of multi-level governance. This research

has discussed institutional capacity and intergovernmental relations in Pakistan in addition to technical barriers. As one example, it was revealed that the small cluster of interactive agencies in China was a key coordinating force (Song et al., 2023), which would indicate the investigation into which Pakistani institutions (federal ministry, provincial agencies, public utility companies, etc.) would have to collaborate on EV policy.

Second, core concept analysis provides important variables to be explored empirically. As an instance, the total cost of ownership and perceived convenience, specifically the availability of charging, are always mentioned as the determinants of adoption (Babar & Ali, 2021; Javid et al., 2022). Thus, it is justified to conduct empirical measurement or modeling of the impact that changes in the levels of subsidies and levels of infrastructure deployment have on the decisions of Pakistani consumers with regards to the adoption of electric vehicles.

Third, the gaps established reveal some research priorities. The shortage of the local studies requires the use of the primary data, i.e. surveys or interviews with the experts, instead of merely using the existing literature. To resolve the problem of equity and system integration, it is necessary to include research questions about the social impacts and grid preparedness. Besides, the focus on policy mix shows the importance of comparative analysis. The policy emerging in Pakistan could be compared with similar economies as proposed in literature of Southeast Asia to determine lessons that could be transferred.

Lastly, the literature warns that it is inadequate to presume that electric vehicles are sustainable in nature (Kumar & Alok, 2020), emphasizing the fact that one should not engage in oversimplistic modelling. This research will therefore assume that the approach chosen is holistic and will be based on multi-criteria analysis and the Multi-Level Perspective (MLP) instead of the quantity of electric vehicles alone. Other sources, including (Madina et al., 2016), point at the need to create

viable business models of charging infrastructure. Thus, this thesis will focus on the financial attributes of electric vehicle implementation, such as consumer financing and investor incentives, as well as technical and political factors.

Finally, the literature review is used to acknowledge the fact that EV transition is a multifaceted and situational process. These three implications to this thesis are: (1) the relationship between policy instruments and stakeholder networks in Pakistan needs to be studied, (2) it is important to understand the role of social acceptance and externalities in the Pakistani population, and (3) it is essential to determine whether the local industry and academia are prepared to change. Based on international and domestic insights, these priorities will be used to address gaps in knowledge and make the study relevant to the national aspirations of Pakistan.

Chapter 4:

Research Methodology

4.1 Introduction and Methodological Justification

This chapter outlines the approach that should be employed to determine and examine barriers to the uptake of sustainable electric vehicles (EVs) in Pakistan through the application of the Multi-Level Perspective (MLP). The research questions, which were presented in Chapter 1, are exploratory and explanatory and address the barriers on various levels and policy deficiencies. The qualitative approach was chosen due to the complexity and novelty of EV adoption in Pakistan. The first source of data was semi-structured expert interviews that were added with the analysis of pertinent policy and industry documents. The approach was selected due to its capability to produce subterranean information, including the view of the stakeholders, and favor a policy-oriented paradigm, which emphasizes contextual knowledge and complexity rather than on generalizability.

Qualitative, interpretive approach is a suitable strategy to use in policy research because it involves a rigorous analysis with reality and practice (Creswell, 2013; Maxwell, 2013). In contrast to the quantitative methods, it permits the questions at the landscape, regime, and niche level, considering such factors as technical, economic, political, and cultural. As there is scanty available literature regarding EV adoption in Pakistan, the expert interviews have been a source of original data that is not available in the literature. Overall, the design was required to be a qualitative and interpretive design that would uncover the how and why behind the challenges of EV adoption rather than quantifying them.

4.1.1 Why select the Multi-Level Perspective (MLP) Framework?

The MLP was the solution of choice compared to other frameworks since it specifically covers the complex transition of EV in Pakistan. Contending methods, including single-level policy analyses or purely economic diffusion models, cannot observe multi-scale interaction. The structured visions of the MLP that divides landscape pressures, regime dynamics, and niche innovations- fits the needs of this research. It allows us to analyze how large-scale forces (e.g. fuel pricing in the world, donor influence) and systemic factors (e.g. bureaucratic segmentation, established auto-manufacturers) combine to influence niche-level outcomes, like pilot EV projects and consumer adoption. In comparison, other frameworks highlight only one aspect: technological innovation systems focus on the industry and technology actors, whereas institutional analysis focuses on governance. MLP offers a higher level of integration. It assists in understanding the difficulties of scaling up niche initiatives in Pakistan, such as EV startups or e-bike initiatives- followed up by identifying the cause of these challenges on regime misalignment (poor governance structures, lack of infrastructure) and landscape instability (economic instability). This multi-level model is more reflective of our research focus, and the real-world interdependency of technical, economic and socio-political forces of the EV shift. Overall, MLP provides a flexible but comprehensive view that other theories fail to offer and can be systematically compared with other alternatives, which makes it possible to find a conclusion that a coordinated, cross-level strategy (identified with the use of MLP analysis) would be more effective in Pakistan than isolated policy changes.

4.2 Research Strategy

A qualitative research approach that was used was an interpretivist one and was used to study the perceptions of the actors, institutional behavior, and social dynamics concerning EV adoption. This

will help in the understanding of the views of the stakeholders, which cannot be measured using quantitative methods. The subjective variables like values, beliefs and motivations were also studied in-depth thus allowing an in-depth analysis of the experiences of the participants, institutional knowledge, and their views of barriers and opportunities. The methodology focuses on the depth rather than breadth; it will record the stakeholder views about the EV transition. Formal hypotheses were not present and the research questions and the MLP framework informed the study. Early interviews made informed subsequent interviews and data analysis was done together with data collection. This is a suitable design in policy research because it links the research findings to actionable recommendations. The participation of policymakers, industry specialists, and scholars made sure that the findings are based on the institutional and social context of Pakistan, which increases the relevance of the policy.

4.3 Integration of Theoretical Framework (MLP)

Multi-Level Perspective (MLP) framework was incorporated in all phases of the research design so that the research questions are connected to the landscape (macro), regime (meso), and niche (micro) levels to cover them thoroughly. In summary:

- Landscape (Macro): External barriers to the country (at the national level). Themes were structural limitations and outside forces (e.g., oil price crises around the world, climate obligations) that affect the EV transition in Pakistan.
- Regime (Meso): Barriers at the organizational and policy levels. Such themes were institutional/regulatory problems, policy coordination problems, industry inertia. The research reviewed the efficacy of EV policies, inter-agency issues, and the limitations of the financial system, as an example.

- Niche (Micro): Grassroot and innovation level factors. This included consumer behavior, technological innovation, pilot projects and local efforts. The issues covered in questions were the challenge of consumer acceptance, the new EV entrepreneurship, and the possible incentives to spread niche innovations.

The mapping of topics on these levels made the study coherent in terms of its theory. The MLP had been used as a checklist to make sure that landscape pressures, regime structures and niche innovations are also taken into account creating a comprehensive picture of the EV transition in Pakistan.

4.4 Sampling

The study used purposive sampling as the selection criterion where the participants were selected in terms of expertise, role and relevancy to the research questions. This approach gave rich case information that illuminated the EV adoption problems in multiple ways in contrast to the approach that would have tried to go and find statistical representativeness (Bryson, 2004). Institutions of EV-relevance were mapped and individuals identified, and high-influence and high-interest actors are prioritized using a stakeholder power interest grid. This strategy was important to guarantee use of both the strategic and technical views (Bryson, 2004).

a) Government Officials: The ministries and agencies (e.g., climate change, industries, energy, transport) relevant to the policy formation and implementation issues may be a source of insight.

b) EV Industry Representatives: Domestic automotive industry players (manufacturers, assemblers, importers, dealers, and industry associations) who provide insights into market realities and industry issues.

c) Academics and Researchers: Academics in the field of sustainable transportation, energy policy or industrial development who can supply data-driven analysis and independent evaluation of the EV ecosystem.

The adherence to the multi-level level of analysis of the given study allowed including the mentioned stakeholder groups to analyze the complex problem of EV transition comprehensively.

4.4.1 Sampling Strategy

These groups of stakeholders were sampled purposely within the groups that had the required expertise. The purpose was to get deep insights as opposed to statistical representativeness. The government officials working on EV or transport policy, the leaders of EV ventures and industry organizations, and the researchers who published or worked as an advisor were the key informants. The last sample consisted of four government officials, six industry representatives (two EV startups and one of an auto industry association), and five academics or researchers adding to fifteen semi-structured interviews. A careful selection of various respondents in each category was ensured to bring a variety in the data set; this was done to make sure that different perspectives are represented in the data. The category-specific saturation was monitored during interviews; the saturation within a category (e.g., academia, industry or policymakers) was reached; at that point, interviews of that category were discontinued. By the fourteenth and fifteenth interviews, a thematic saturation was achieved after interviewing was done in general. There were no additional codes or themes produced during the final interviews implying that additional interviews would

not yield much information. The overlapping of the ideas of participants meant that 15 interviews reflected the breadth of the insights that pertained to the research questions. The availability of informants also restricted the selection, although there was saturation, which ascertained the sufficiency of the sample.

4.5 Methods of Data Collection

Data collection centered on semi-structured expert interviews, guided by the MLP framework; an interview guide (Section 4.5.2) ensured coverage of core topics.

4.5.1 Semi-Structured Expert Interviews

The main data collection was semi-structured expert interviews, which is a compromise between consistency and flexibility. The interview guide (see Section 4.5.2) covered the main MLP issues but allowed free-flowing and in-depth conversation. The duration of the interviews ranged between 45 and 60 minutes and was made either through Zoom or face-to-face depending on how the participants preferred it. All the interviews were audio-taped with the consent of participants and transcribed verbatim to have a focused interaction during interviews as well as to carefully analyze the answers. The semi-structured design allowed probing on the important points and made it complete to cover all important issues.

4.5.2 Interview Guide

The interview guide was structured into thematic sections (macro, meso, micro, plus forward-looking questions) as a flexible checklist rather than a strict script. The main sections and example questions (phrased to suit each interviewee) were:

a) **Macro-level – Policy Ambition & Infrastructure:** Gauged perceptions of Pakistan's overarching EV goals and capacity. Example: "How achievable are Pakistan's policy targets (e.g., 30% EV share by 2030) given current economic conditions and infrastructure?" This invited discussion of broad landscape pressures (→ RQ1).

b) **Meso-level – Institutional & Regulatory Frameworks:** Explored regime-level barriers. Example: "What are the most critical institutional or regulatory barriers impeding Pakistan's EV policy implementation, and how could federal-provincial coordination be improved to avoid disconnects?" (→ RQ2).

c) **Micro-level – Consumer Perception & Affordability:** Addressed end-user factors. Example: "How do economic barriers (affordability, financing) shape consumer attitudes toward EVs? What incentives could significantly increase EV uptake?" (→ RQ1, RQ2).

d) **Environmental & Sustainability:** Asked how environmental awareness influences EV adoption. Example: "Do climate and air-quality concerns make EVs more appealing in Pakistan? Would initiatives like renewable energy integration increase consumer interest?" (→ RQ1).

e) **International Insights:** Elicited comparative ideas: "What policies or practices from other countries (e.g. India, Vietnam) could Pakistan feasibly adopt to accelerate its EV transition?" (→ RQ2).

f) **Policy Recommendations:** Sought interviewees' own suggestions: "Considering the barriers we've discussed, what key policy actions would you prioritize to ensure a successful EV transition in Pakistan?" (→ RQ2).

4.6 Data Analysis Procedure

4.6.1 Thematic Analysis

Interview transcripts and document analysis were analyzed using thematic analysis, following the six-step approach established by (Braun & Clarke, 2006).

1. **Familiarization:** The data were reviewed repeatedly, including interview transcripts and policy documents, with initial margin notes recorded. This process facilitated identification of recurring ideas and distinct stakeholder perspectives.
2. **Initial Coding:** Inductive and deductive coding approaches were applied using NVivo 14 qualitative analysis software to ensure rigor and organization. Deductive codes were derived from the Multi-Level Perspective (MLP) framework and research questions, including codes such as "landscape_pressure," "regime_lockin," and "niche_innovation." Inductive codes emerged from the data, for example, *"charging_station_vandalism"* when multiple sources referenced charger misuse. Each transcript was coded line by line, with relevant codes assigned to specific text segments.
3. **Searching for Themes:** Codes were examined for patterns and grouped into potential themes. Codes were organized into higher-level thematic categories that corresponded to analytical levels and cross-cutting issues. For example, codes related to government issues, such as "policy_incoherence," "regulatory_conflict," and "implementation_gap," were grouped under the theme "Policy and Institutional Barriers." Codes concerning consumer and cultural issues, including "awareness_gap," "status_symbol_ICE," and "range_anxiety," formed the theme "Consumer Perception and Cultural Barriers."

Additional themes included “Economic and Financial Barriers,” “Infrastructure and Energy Constraints,” and “Local Industry Challenges.” These themes reflected barriers identified in the literature review and were refined with empirical data.

4. **Themes Reviews:** Themes were checked systematically against the data that were coded and the whole dataset to ensure that the themes were very much related and distinct. Some of the themes were combined, and others were developed at this stage. As an example, the initially distinct themes of Institutional Fragmentation and Policy Inadequacy were merged in the theme Governance and Policy Challenges since they are interconnected in the data. Adequate and representative data was provided to support each theme, so the examples were patterned responses as opposed to outliers. Themes which were not supported properly or which had too much overlap with others were refined or dropped.

5. **Defining and Naming Themes:** Every completed theme was described with reference to the research questions and Multi-Level Perspective (MLP) levels. Each of the themes was elaborated, indicating how he or she is reflected in the Pakistani context and what its importance is. Indicatively, the "Economic and Financial Barriers" was explained as the elements on the cost of electric vehicles, financial incentives, and the market conditions that hinder the adoption, and these include the imbalance in the cost of upfront costs, the financial means of financing acquisition, and the utilization of import costs. Themes were directly connected with MLP levels, such as Governance and Policy Challenges is associated with regime-level barriers, whereas Social Perception and Awareness is associated with the issue of regime norms and niche diffusion challenges. This process helped to explain the meaning and applicability of each theme.

6. **Creation of the Report:** In the last phase, the themes were incorporated as a narrative in the Results chapter to answer the research questions. Each of the themes was described by direct quotes of interviewees with the following level of anonymity: G1 Government interviewee 1; I2 Industry interviewee 2. The thematic analysis was clearly related to the theoretical framework in which the barrier themes were influenced to either misalignment in Multi-Level Perspective (MLP) levels or the niche success stories did have pressure on the regime. There were thematic insights on which the entire policy was reflective and prescriptive as per the research objectives. A basis on which certain policy recommendations should be made was laid by observing solutions that were implied or desired by stakeholders to each barrier. The recommendations were formed in Recommendations chapter in detail.

Table 4.1: Thematic analysis Coding

Node (Leaf)/Code	Parent Theme	Descriptor (phrases only)	Sector	Level	RQ	Evidence Anchors
policy_target_gap	Policy Ambition vs. Implementation Gap	30% by 2030 target aspirational; progress lagging	G/I/A	Macro/Meso	RQ1	G1, I1, A1
implementation_shortfall	Policy Ambition vs. Implementation Gap	incentives delayed; pilot projects partial	G/I/A	Meso	RQ1, RQ2	G2, I2, A2
institutional_silos	Institutional Fragmentation & Coordination	overlapping mandates; no lead agency	G/I/A	Meso	RQ1, RQ2	G1, I2, A1
regulatory_void	Institutional Fragmentation & Coordination	missing EV safety/charger rules; unclear regulations	G/I/A	Meso	RQ2	G3, I3, A2
rent_seeking	Institutional Fragmentation & Coordination	licensing delays; corruption; incumbents blocking entry	I/A	Meso	RQ1	I1, I2, A3
charging_gap	Infrastructure & Energy Constraints	<50 stations; 75% offline during load-shedding	G/I/A	Macro/Meso	RQ1	G1, I1, A1
grid_unreliability	Infrastructure & Energy Constraints	load-shedding; fossil-heavy grid reduces EV benefits	G/A	Macro	RQ1	G2, A2
cost_barrier	Economic & Financial Barriers	EVs 20–60% costlier; bikes twice petrol alternatives	G/I/A	Micro	RQ1	G1, I1, A1

financing_gap	Economic & Financial Barriers	banks risk-averse; high interest auto loans	I/A	Micro/Meso	RQ1, RQ2	I2, A2
subsidy_inefficiency	Economic & Financial Barriers	rebates delayed; funding uncertain	G/I	Meso	RQ2	G2, I3
awareness_gap	Consumer Awareness & Acceptance	low EV knowledge; doubts on reliability	G/I/A	Micro	RQ1	G1, I2, A2
cultural_resistance	Consumer Awareness & Acceptance	EVs seen as luxury; ICE status symbols persist	I/A	Micro	RQ1	I2, A3
local_capacity_gap	Local Industry vs. Import Dependence	reliance on imports; minimal local EV manufacturing	G/I/A	Meso	RQ1, RQ2	G1, I1, A1
skills_gap	Local Industry vs. Import Dependence	technicians untrained; few R&D facilities	G/A	Meso/Micro	RQ1	G2, A2
policy_discontinuity	Policy Continuity & Learning	frequent shifts; incentives reversed; CNG plan dropped	I/A	Meso	RQ2	I3, A1
adaptive_learning	Policy Continuity & Learning	new 2025–30 policy adds reviews; steering committee	G/A	Meso	RQ2	G1, A2

4.6.2 Innovative Analytical Methods and Tools

Complementary practices were also employed. The analysis of the policy narrative showed the way interviewees positioned EV adoption (as an economic opportunity or an environmental imperative). The queries of NVivo (word frequencies, matrix coding) revealed the patterns of cross-stakeholders. These patterns were demonstrated and verified with the help of simple visualizations (bar charts, conceptual maps). These techniques triangulated and enhanced thematic results.

4.7 Triangulation, Reliability and validity

The issues of validity and reliability were resolved in a variety of ways (Golafshani, 2003). The triangulation of data sources and perspectives and member checks were also used to increase credibility. The description of contexts by means of the MLP framework contributed to transferability. The audit trail (logs, coding records, peer review) was used to ensure dependability. The confirmability was achieved by means of reflexive notes in confirmation and grounding of findings on direct interview quotations.

4.8 Ethical Considerations

All interviews had rigid ethical codes. The subjects received information on the purpose of the study and voluntary consent and could choose not to answer or pull out at any point in time. Anonymity and confidentiality were ensured: no names and other identifiable information were provided in the transcripts and reports. The data were carefully placed in a secure place that can only be accessed by the researcher and a confidential transcriber. The questions were phrased

neutrally to prevent any sensitivity and discomfort, and the principle of do no harm was adhered to by the researcher.

4.9 Limitations and Reflexivity

This qualitative research has several limitations. The depth, purposive sample limits the statistical generalizability. The view of the average EV consumers has not been given and the interviewees might have been biased on the responses. Triangulation of data sources, and the search of divergent opinions was used to overcome these limitations. The fast-changing EV industry can also influence the applicability of results because the post-2023 policy and market alterations might change the circumstances. The analysis was done with the help of reflexivity by recognizing personal biases and deliberately seeking the skeptical perspective to provide balance and objectivity.

4.10 Research Locale

This research was concerned with the largest urban areas in Pakistan, i.e. Islamabad, Lahore and Karachi. The federal capital is Islamabad, which is the home of the national policymakers and regulators. Lahore and Karachi are overcrowded industrial cities with high air pollution, which are the obvious locations of early EV projects and pilot projects. The interviews with stakeholders and these settings offered an understanding of how the various political, economic, and social environments influence the EV transition in Pakistan.

4.11 Chapter Conclusion

The qualitative approach with MLP information enabled a well-developed, consistent structure of investigating the barriers to EV adoption in Pakistan. The systematic incorporation of theoretical

levels in all research stages also enabled the study to deliver holistic, contextually based results. The interviews with experts have produced extremely subtle results with the help of exquisite thematic analysis and triangulation that quantitative designs would not have detected. This method, despite its weaknesses, forms a strong basis of coming up with the appropriate policy recommendations in the following chapter.

Chapter 5:

Results

This chapter contains the qualitative results of the research which is structured according to seven major hurdles in the transition process of EV in Pakistan. These were (1) Policy Ambition vs. Implementation Gap, (2) Institutional Coordination Challenges, (3) Infrastructure and Energy Constraints, (4) Economic and Financial Barriers, (5) Consumer Awareness and Acceptance, (6) Local Industry Development vs. Import Dependence, and (7) Policy Continuity and Learning, which are identified as thematic analysis outcomes. All of the themes are colored by macro, meso or micro level barriers pertinent to the research questions and the MLP framework and are presented in the prism of the government, Industry and academia.

The findings are given on the basis of the original meaning, sequence and supporting evidence in the interviews. Each finding is represented by direct quotations, G# when the author is a government official, I# when the author is an industry expert, and A# when the author is an academic. Where necessary, interview data are backed with references to policy documents and other literature mentioned above. Cited information is not changed. The themes are presented in the points of view of the government stakeholders, then industry and academia to represent an all-around analysis.

5.1 Theme 1: EV Policy Ambition vs. Implementation Gap

Government Perspective

The government officials found a huge gap between the declared goals of the policy concerning the electric vehicle (EV) and its real results. It has set a 2030 goal of reaching 30% of all electric vehicle sales to show dedication and involvement of some stakeholders. Nevertheless, it has not been able to make any progress due to the continued economic and infrastructure problems. Authorities insist that the goal can be achieved through accelerated and massive interventions, but the ongoing programs are not in line with policy ambition, and there is always a gap between the strategic vision and the actual improvement.

According to reports prepared by officials, the ambitious target has created momentum that has led to actions like offering tax incentives, pilot projects and modifications to the policy. The 30 percent is termed as pragmatic optimism: idealistic, but undecided but useful in ensuring continuation of ongoing programs. The authorities discuss the necessity of increasing the implementation by providing more investments, encouraging local assembly, infrastructure growth, and economic stabilization to close the gap between the policy aspiration and the real results. This theme shows that the EV policy of Pakistan is still partially implementable only without significant interventions, as is the case with Research Question 1 (RQ1).

Industry Perspective

Stakeholders in the industry are mostly of the opinion that the EV targets set by the government are rather ambitious given the existing constraints. According to a few experts, the 30% by 2030 goal would not be achieved unless there is a huge capacity-building and policy support. These

stakeholders insist that the EV market of Pakistan will continue developing limitedly unless the conditions of the market foundations are enhanced. The dependency of importing or assembling EVs to a small domestic market is said to be low concerning the necessary growth. One of the players in the automotive industry with years of experience (I1) speaks that Pakistan needs to produce more and develop local EV parts to export to achieve the goal. He also notes that the nation has already been deprived of old chances at automotive industrialization and is unlikely to achieve EV adoption without a strong local industry as suggests Theme 6.

The industry players observe that electric cars are a luxury good since the incentives currently in place have not enabled them to be widely accessible and affordable. They suggest focusing on short-term, feasible actions like the electrification of motorcycles, rickshaws, and buses in order to create momentum. Such stakeholders emphasize that policy ambitions need real activity to prevent being just idealistic. The development will rely on the improvement of industrial production in the region, cost-cutting, and improvement of infrastructure.

Academia Perspective

According to academic analysts, there is very little likelihood of reaching the 30 percent EV sales target by 2030, owing to the poor current EV market, strong economic issues and lack of proper infrastructure in Pakistan. They cite high inflation, limited government resources as key issues, and they add that the absence of charging stations and unreliable access to electricity is an additional hitch to mass adoption of EVs.

Scholars have noted that such a high goal motivates stakeholders and initiates a move, even though its success rate is low. They suggest that they set interim milestones, including attaining a 10-15%

EV market share by 2030. The incremental achievements like the sale of more e-bikes are hopeful indicators of accomplishing certain sub-goals.

Scholars believe that the EV policy is excessive when it is not accompanied by thorough changes in all spheres and is therefore partially unimplementable. However, they suggest keeping the ambitious target to trigger massive investment, high incentives and creative initiatives. A 30 percent EV sales target by 2030 is unlikely to be reached, but having a large goal is perceived as a superior way to make progress compared to a conservative one. The major issue is that there is still the gap between policy ambition and practical implementation.

5.2 Theme 2: Institutional Fragmentation and Coordination

Government Perspective

Fragmented governance was cited by the government interviewees as one of the biggest obstacles to successful implementation of the electric vehicle (EV) policy in Pakistan. The institutional environment was characterized as very siloed and not coordinated. Even though the EV policy was created at the federal level of the state, the tasks of the implementation were assigned to various ministries, agencies, and provincial authorities, without a specific head. Federal policy would not be able to realize its desired results by provincial collaboration because of the fact that transport is mainly a provincial duty. This lack of adherence led to irregular development. The project like the implementation of electric buses and the charging infrastructure was delayed because of the fragmentation of jurisdiction. Car producers were slow to respond to EV needs that were set by regulatory bodies. The agencies that were used to traditional vehicles were reluctant to revise the standards and incentives. Consequently, divergent efforts were rife and the incentives in one

jurisdiction were at times nullified by competing rules in another jurisdiction. In an example, a province abolished specific charges to facilitate the use of EVs, whereas another added new charges, and this left the consumers and manufacturers in confusion. First, there was no special federal task force or a committee to manage the stakeholders of the climate, industry, finance, and energy ministries. Lack of central supervision and coordination resulted in lack of accountability and adoption of policies where most of them were not implemented.

To address these issues, the government representatives have embarked on ensuring that coordination mechanisms are put in place. As an illustration, the setting up of the Prime Ministers Committee on Climate Change that incorporates provincial chief ministers was aimed at ensuring that the provinces would provide cross-provincial backing to the climate efforts like electric vehicles. The draft National Electric Vehicle (NEV) Policy 2025-30 also includes a National EV Steering Committee and a National EV Center (NEVC) to be centralized coordination centers. These agencies will bring together the stakeholders and straighten out the chains of command in implementing the EV policy. These measures are essential when it comes to dealing with past fragmentation as highlighted by the officials. The issue of lack of centrality is set to be resolved by having the NEVC, which is supposed to centralize the standard-setting, incentive management, and progress monitoring. Nonetheless, there were officials who warned that these bodies need to have the necessary power and resources to work. All in all, the implementation lapses described by the government are linked to disjointed governance and the government now focuses more on the increased coordination between agencies and across state borders. The establishment of coordination forums shows that policy success requires integrated execution. This is also a solution to another major weakness of the 2019 policy, which is lack of a well-coordinated implementation mechanism.

Industry Perspective

Affirmation of government concerns was achieved through private-sector players who identified the barriers to policy implementation of electric vehicle (EV) in the form of bureaucratic and institutional. The stakeholders in the industry claimed that policy objectives do not bear realistic results because of the inherent governance problems. Slow approval of products, administration of too much red tape and in some scenarios, corruption characterizes the business environment. To illustrate, (I1) stated that some officials took bribes to give manufacturing permits to EV projects, which does not encourage industry involvement and local investment. This makes the entrepreneurs reluctant to invest in EV projects, with or without policy incentives, because of the fear of administrative obstacles and rent-seeking activities. Other interviewees (I2, I3) noted that agencies like the Engineering Development Board (EDB) were inefficient in the past to handle EV-related applications, which put a strain on new companies to enter. According to one industry analyst, the automotive industry has a regulatory environment that is dominated by the existing players. This superiority encourages new companies with an interest in EV to join the market with complex licensing policies and lack of technical standards. The existence of institutional inertia and the desire to preserve the status quo by legacy automakers, which frequently affect the regulatory process, only complicates the EV transition. The sector thus sees both disintegration of government institutions and proactive opposition to change by the entities who are in keeping with the current automotive industry.

The respondents in the industry suggest institutional reforms as a way of enhancing efficiency of governance. They suggest creating an electric vehicle facilitation cell which will be central to the government to deal with all the approvals, permits, and inquiries concerning the EV businesses.

Besides, they support the digitalization and speed up of the licensing procedure to shorten the time of approval and eliminate unnecessary interventions leading to better business climate of EV ventures. The representatives of the industry support the idea that the policy documents should be provided with procedural and coordination issues to reach their desired effects. According to the industry opinion, absence of proper institutional implementation mechanism is the key challenge to EV adoption in Pakistan and not shortage of policy planning. Better administration, uniformity in administration, removal of rent seeking, and coherent government attitude is believed to be the key to enhancing investor confidence. In short, industry views support the government in realizing institutional fragmentation and the necessity of an improved coordination policy and governance in order to implement EV policies successfully.

Academia Perspective

In their discussion, academics and policy analysts have evaluated broadly the institutional failings that have contributed to the failure of the successful undertaking of the National Electric Vehicle Policy (NEVP) in Pakistan since its declaration in 2019. The lack of ownership of the policy is determined as the main problem because of the duplication of duties of different ministries of the government such as Climate Change, Industries, Finance, and Energy. This disjointed system of governance has led to vague technical specifications of the batteries of electric vehicles (EV) and charging cords, and inconsistent policies of registration and taxation, which have caused confusion to investors and implementers.

The researchers particularly pointed to the lack of an effective regulatory framework that has weakened the participation of the private sector because of the non-existence of clear guidelines and motivators. It is important to note that no set standards existed in terms of EV safety, charging,

or production before the policy was put in place, which is why a serious gap in regulation exists, and safety issues have been brought up due to poor-quality products entering the market. Whereas the 2025-30 policy is focused on the achievement of these regulatory shortfalls through the introduction of testing processes and technical standards, realisation of such measures will involve administrative capability, as well as the political will.

Also, researchers identified the institutional capacity constraints of regulators and testing agencies who have to be prepared to deal with new technologies. The rising number of new EV manufacturers, especially two-wheeler startups, also complicates the quality control as the standards of the chargers and components are mainly founded on international standards. The current lack of clear standards can be an obstacle in terms of consumer adoption as prospective customers tend to want to know more about the safety and reliability of EVs and EV chargers.

The resistance of the old players in the industry and institutional inertia also came as a major obstacle to the implementation of EV policy. The existing car manufacturers are able to sway the policymakers to advance their interests, and this has contributed to resistance to reforms that are likely to threaten their market share. The delays in the development of EV programs can therefore be blamed on lobbying workforce and institutional resistance whereby the stakeholders who are enjoying the status quo have no reason why they would want the rapid adoption of the EV.

In order to respond to these complex problems, the scholars underlined the urgent necessity of new institutional structures and more developed coordination mechanisms. One of the recommendations is the formation of a National EV Council which is charged with the responsibility of harmonizing federal and provincial regulators to harmonize regulations. This agency would harmonize incentives, including common registration charges in all provinces, and

develop a simplified procedure on permits and approvals. This plan goes hand in hand with the current efforts by the government in the EV Steering Committee and the National Electric Vehicle Council (NEVC).

Finally, the academic community points out that the institutional reform is an urgent and complicated aspect of EV policy implementation. The researchers concluded that institutional barriers preventing the adoption of EV policies are associated with a high degree of a lack of alignment between various stakeholders, as opposed to individual performance of regulatory agencies. The solutions to these challenges have enabled the stakeholders to develop new policy interventions that aim at establishing coordination organs and explaining regulatory frameworks. This cooperative model between government, industry and academia indicates a good trend along the path of good policy change which is a common perception of the problem and determination to seek harmonious solutions. The fact that the coordination issue that used to be deemed as a significant vulnerability is transformed into a shared priority outlines the possibility of the successful implementation of the EV policy in Pakistan.

5.3 Theme 3: Infrastructure and Energy Constraints

Government Perspective

Poor charging infrastructure and unreliable power supply has been cited as some of the major obstacles towards the use of electric vehicle (EVs) in Pakistan by various stakeholder groups. This is what the government officials explain as a charging network gap. By the middle of 2020, there were less than 50 publicly available charging stations throughout the country, most of which were often offline through load shedding. This shortage is worsened in places outside of large cities like

Karachi, Lahore, and Islamabad and makes inter-city EV travel almost impossible. Until 2023, some 30 or so public chargers were in place, of which only some 20 were consistently functional. During power outages, up to 75 percent may be off-line. This ongoing lack of reliability makes the range anxiety more severe and, as the representatives of the ministry of energy claim, leads to the decrease in the confidence of the consumers toward the daily charging.

The government officials recognize a possibility of matching EV deployment with the power sector enhancement. The excess of off-peak electricity production in Pakistan can be used with the help of smart charging management and overnight rates, which can potentially encourage individuals to invest in the creation of a charging network. According to officials, the development of charging infrastructure should be accompanied by grid enhancement and the introduction of renewable energy sources like solar power or battery reserve. The next EV policy is the development of 3,000 public stations by 2030, which will be largely through highway-based public-private partnerships. Policymakers agree that infrastructural strength and grid stability are the conditions that EVs must adopt, which confirms the result of RQ1 that infrastructure is essential. Improving the state of charging infrastructure and grid capacity is taken as significant as giving economic benefits.

Industry Perspective

The major limitation that industry experts point to in the case of electric vehicle (EV) manufacturers and fleet operators is the lack of infrastructure. Many enterprises delay the launch of EVs or conversion of the fleet because the choice of charging is reduced to pilot projects. The initial importers had to contend with serious issues that occurred due to the apprehension of customers on the issue of charging availability. According to business owners, a reliable charging

network is lacking, and it is one of the reasons why EV investment is not made, causing the delay in the entry of the private sector until the infrastructure is enhanced.

A number of industry players have argued that the government must intervene to start the development of infrastructures because without an established demand, it is unlikely to invest in infrastructure development. They refer to foreign cases of subsidies or utility requirements that have been effective in increasing charging networks. A lack of chargers deters the consumer and business, creating an issue of demand and supply stalemate. One of the proposals made by industry representatives is to categorize early infrastructure investment as a public good that needs to be led by the government, and they are willing to cooperate provided the policy direction is well-defined.

According to the interviewees, free or reduced land, free power, and tax breaks are suggested to encourage the development of charging stations, which underscores the necessity of the infrastructure improvement. These gaps have been realized in the past policies and are being addressed during the revision of the current policy. The improvement is suggested by stakeholders through specific investment, incentives offered by the private sector, and the partnership of the government and the private sector, and network expansion is one of the key policy interventions that will help to meet the governmental goals.

Academia Perspective

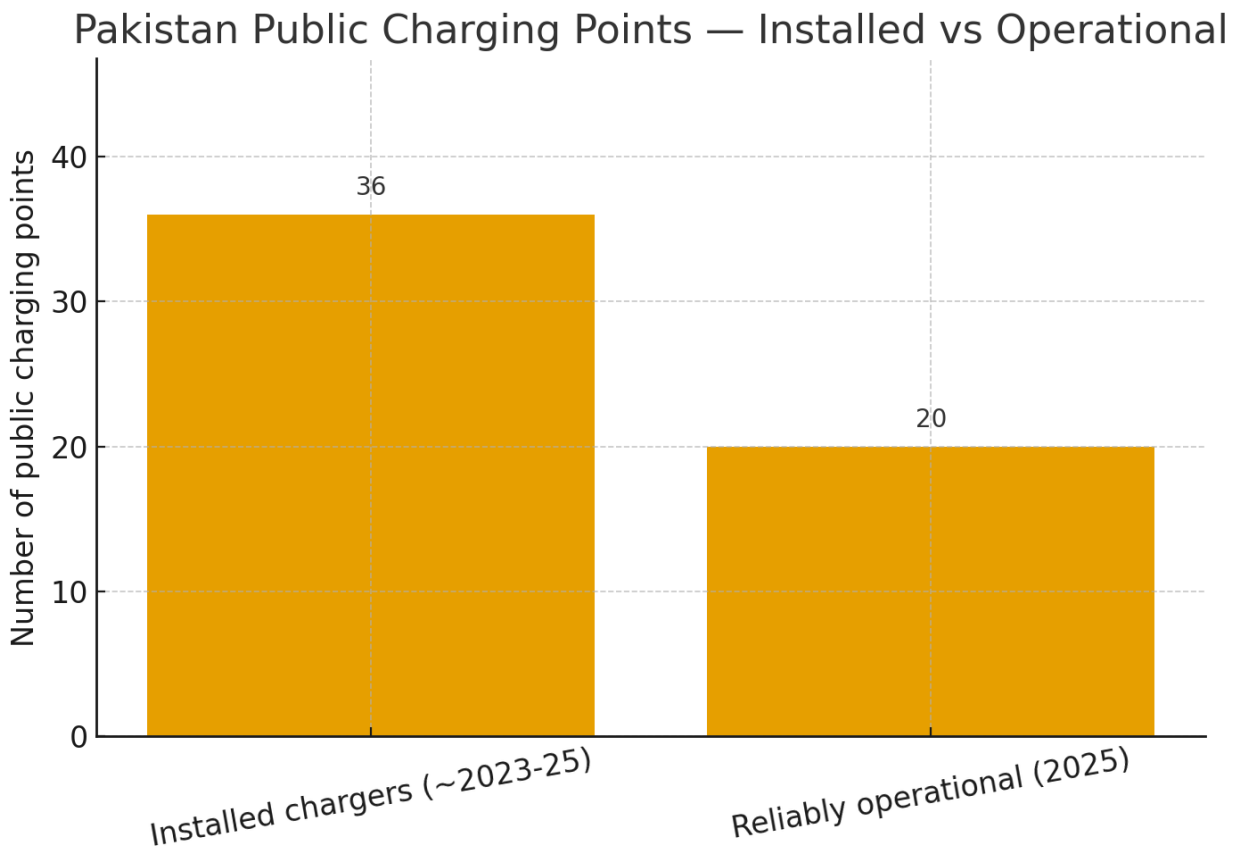
A major meso-level obstacle that is cited by academic and energy experts is the inhibition of infrastructure. Less than 50 public charging points are used by a population of above 220 million, which is inadequate to cater to that of the urban population. Having around 20 functional stations

in the country in 2025, specialists underline the importance of the exponential increase in order to create the working EV fleet. The comparisons with countries like Vietnam and India highlights the gradual development of Pakistan, especially in the inter-city travelling paths.

Reliability and power capacity of the chargers are discussed by academics as well, and a huge number of chargers in Pakistan are slow and often go offline. They even suggest solutions that integrate chargers and backup power and better grid stability. Other experts note that the grid reliant on fossil fuels can potentially reduce the environmental gains and suggests renewable energy sources to be integrated to charge EVs to overcome the perception of public and environmental concerns.

In short, it is possible to conclude that all the perspectives find infrastructural barriers as a fundamental element. Lack of charging stations and grid inadequacies are two issues that should be resolved along with the consumer-oriented policies, which proves the correctness of RQ1 in identifying such obstacles as a major barrier. To solve these problems, it is necessary to introduce bold infrastructure goals, novel funding solutions, grid modernization, and unification with renewable sources. Stakeholders also claim that EV adoption will not be high unless scaling such measures is done. Poor infrastructure is a manifestation of the current energy crisis as well as contributing fact to the lack of consumer confidence. To promote the use of EV, charging networks and grid reliability should be invested in.

Fig 5.1: Pakistan Public Charging points – Installed vs operational



Reference: Authors own illustration from online sources

5.4 Theme 4: Economic and Financial Barriers to Adoption

Government Perspective

High initial prices and absence of cheap funding are always mentioned by government representatives as significant obstacles to consumer EV adoption, and filling these in with affordability and incentives. According to one official, the affordability is the key to EV adoption in Pakistan (G1), because the prices are highly sensitive among buyers. The recent researches demonstrate that EVs in Pakistan are 20-40 more expensive than gasoline cars in the short-run:

EVs represent a luxury purchase. (G1) pointed out that until this gap is bridged adoption will be restricted to better-off early adopters or company fleets.

The government has in turn responded with a series of fiscal incentives over the last few years to make the purchase of electric vehicles (EVs) cheaper. Particularly, the sales tax (General Sales Tax, GST) imposed on EVs dropped to 1% instead of 17% and the duty on the import of EV components was lowered to 5% or lower. Such tax cuts have greatly reduced the price of imported EVs, cutting the price of vehicles by large margins. Under the new EV policy, the government also introduced direct purchase subsidies aside of tax policy. As an illustration, the subsidies on electric two-wheelers and three-wheelers (rickshaws) are now subsidized at approximately, Rs. 65,000 and Rs. 400,000 respectively and they contribute directly to lowering the costs of purchasing the products. They are also planning a subsidy of each kilowatt-hour of battery capacity to buy electric cars, but rebates on cars are quite sparse because of financial reasons. These are aimed at solving the affordability challenge to EV adoption.

The government has focused on funding EV adoption besides price cuts. The officials have liaised with the State Bank of Pakistan and commercial banks to come up with green auto-financing plans. Indicatively, in Punjab, a program allows students to acquire electric motorcycles within their installment schemes that are interest-free, leading to a high demand. These programs will make EVs more accessible to middle-income consumers who are unable to make full down payments since they can pay them over a specific timeframe with little or no interest. Other benefits are the free registration of vehicles and the exemption of road taxes on EVs in places like Islamabad Capital Territory and Sindh, which further lowers the ownership cost.

The government plans to enable the consumers to adopt electric vehicles by providing specific economic incentives. Without this kind of measure, most purchasers will probably choose cheaper used petroleum vehicles. Tax subsidies, rebates, and loans are seen as critical in overcoming the cost barrier until the prices of electric vehicles are brought down by economies of scale. These are interim investments aimed to spur growth in the market and make them affordable as the biggest obstacle to adoption.

Industry Perspective

According to the automotive industry stakeholders, high initial costs are found to be the biggest obstacle to electric vehicles (EVs) uptake in Pakistan. Automakers and importers point at the huge price premiums that EVs impose, making them in-competitive in a price-sensitive market. As an example, the price of the MG ZS EV of about Rs9 million is very far in between the cost of the Toyota Corolla of about Rs6.5 million, which translates to a 40 percent higher price that most middle-income consumers cannot afford.

This situation is also complicated by the financing environment as many consumers have been shown to use loans to buy cars, but the existing car loans have high interest rates (approximately 18 percent per annum), and, as of 2023, none of the banks have created car-specific financial products (not even EV). This has limited access to potential customers who would otherwise be able to afford an EV due to lack of financing options. Industry critics are pushing the government to step in along the same lines as other countries like India and China which have introduced enticing early subsidies to ease EV penetration.

The example given is the FAME program in India, which provides purchase subsidies, local production incentives, leading to more EV sales. The industry proposes similar policies to be adopted by Pakistan such as subsidizing local-produced EVs and removing some taxation not only to increase adoption of EV but also to support local production. The creation of EV components in the country is seen as a long-term option to save money and decrease the risks linked to exchange rates, which may cause the decrease of consumer prices.

Although the industry is optimistic about recent government announcements on subsidies on electric bikes and rickshaws, they point at the need to make them effective. Past experiences, including the aspects of delays and funds uncertainties due to the introduction of the 50 000 rupee subsidy on electric motorcycles in 2022, have created frustration among the interested parties. They claim that failure to incentivize the consumer effectively kills confidence in government programs.

In a bid to encourage the expansion of EV adoption, industry players propose to enhance financing solutions by partnering with the banks to provide electric vehicles loans and provide interest rates reductions. The recent participation of the State Bank of Pakistan in the green financing projects is considered positive, which indicates a possibility of more consumers being able to have access. Finally, the agreement of the industry emphasizes that the affordability issue is a core aspect of increased adoption of electric vehicles. Though the governmental initiatives that are already in place are accepted, stakeholders insist on more significant incentives that will help to reduce EV prices in the short term and enable a more active uptake.

Academia Perspective

The scholars are centered on economic and financial obstacles to EV uptake and provide definite empirical comparisons. They observe that the price elasticity of demand in the EV market in Pakistan is high: the majority of the population refuses to spend more money on EVs in the short run than on their counterparts. The studies suggest that EVs, including taxes and importation expenses, cost 50-60 percent more than other ICEs of the same models- comparable to previous findings of a 40 percent car premium. This is a high-priced price that is exclusive in a market where buying a car is a luxury and costly. (A2) and (A1) measured the fact that the electric motorbikes can be twice as expensive as petrol bikes and cars are millions higher. These huge disparities severely discourage the demand of EVs as majority of the consumers choose traditional products.

The problem of funding was also mentioned by academics since there was no major bank that provided a special EV loan product until 2023. In Pakistan, the general auto loans are charged with high interest rates and have short periods of repayment. Both (A2) and Iftikhar (A1) stated that the local banks have also been risk averse towards EVs, unwilling to finance them as they were unfamiliar assets with uncertain resale value, and had not offered them the same financing scheme as conventional cars. Such deficit of financing implies that even interested buyers cannot afford the cost of an EV over time very easily and this is a substantial setback in a market where installment purchasing is the usual practice in purchasing vehicles.

Scholars agree that the biggest factor in consumer choices is affordability. Most customers are driven by economic factors as opposed to environmental reasons. Tax and subsidy incentives are considered to be needed but other scholars believe that the incentives might not be adequate yet.

They suggest supporting five to ten years when prices are going down or local production is lowering its costs. In the meantime, the importation of cheaper models would assist in filling the gap in affordability.

Academically, scholars were delighted that SBP was also considering green financing, and that new financial tools (such as partial credit guarantees on EV loans or interest subversion) could radically change its uptake in case of a well-imposed solution. They also demonstrated the need to make the lenders less risky - e.g., insured EV batteries or allow buy-back guarantees, to convince banks on the resale value.

Scholarly evidence supports that affordability is a very important variable, which is consistent with the viewpoints of government and industry. First policy of electric vehicles lacked adequate incentives to the consumers, but in recent times with subsidies, tax cuts and loan programs, this has started being filled. This agreement by the interested parties promotes coherence in policy in the future. The biggest problem is good and efficient execution of these measures in order to make the electric vehicles affordable and to popularize them in Pakistan.

5.5 Theme 5: Consumer Awareness and Acceptance

Government Perspective

As government officials admit, consumer perceptions are one of the factors that influence the adoption of electric vehicles (EVs), but these perceptions are perceived as less significant factors compared to economic obstacles. According to the reports of the officials, the level of awareness of the benefits of EV in Pakistan is still low, and most consumers doubt the practicability of EVs. Consequently, there has been an upsurge in policy drives favoring communal message and

education. One of the core approaches consists of emphasizing local advantages, e.g. less smog in Lahore and Karachi and better health of the population, instead of concentrating purely on global climate effects. The government is establishing campaigns that relate EV adoption to communal welfare, financial saving on healthcare, modernization, and carbon cut down.

Based on these messaging campaigns, interviews indicated that the Ministry of Climate Change, as well as provincial environment ministries, intends to conduct outreach programs to demonstrate how EVs put out no tailpipe emissions, are less noisy and may save money on fuel. However, the authorities are also aware that the awareness campaigns will not produce significant results until the practical matters are tackled first, including cost and convenience. Climate and health benefits, as one is frankly saying, are wonderful, but a typical buyer who comes to this business asks: what will it cost me and will it be reliable? To that end, the communications of the government include the focus that they are focusing on those major issues (with the incentives and the infrastructure projects mentioned above), but that they are also trying to fix the image of EVs.

Guaranteeing the population that EVs will not produce new environmental issues is another government concern, which contributes to the establishment of trust among the environmentally conscious citizens. Authorities stressed the fact that the new EV policy deals with battery recycling and disposal. The policy provides measures on how used batteries shall be collected and it requires Extended Producer Responsibility (EPR) by the manufacturers to be in control of end-of-life batteries. By their communication that EV adoption will come with responsible recycling and congruency with the utilization of renewable energy, the government will endeavor to reassure the people that we will not replace air pollution with toxic battery waste and make EVs a more viable option as a long-term green measure.

The government acknowledges the need to develop consumer acceptance by increasing their understanding of the benefits of EVs and eliminating the cultural bias. To overcome such obstacles, specific messaging and displays of initial EV implementations, including electric bus pilot programs, is utilized to develop social confidence. This effort handles non-financial policy gaps as found in RQ2. Although consumer awareness has been a secondary concern, the present activity is increased to supplement the technical policies. The government focuses on overcoming both the real challenges in the market and perceptions of people, thus equipping people to accept EVs once these issues are reduced in terms of cost and availability.

Industry Perspective

The industry stakeholders do not focus on consumer awareness of electric vehicles (EVs) as much as they pay attention to economic and infrastructural issues. These stakeholders present the argument that when EVs can be affordable and with a proper charging infrastructure in place, the rate of consumer buying the product will rise. They consider the existing market as developing and the first users are more knowledgeable with the majority of consumers being unaware of EVs because they have a low presence in the market, are very expensive, and there is a lack of charging infrastructure. Representatives of the industry explain such consumer distrust by the immaturity of the existing market, and expect that such attitudes will change as the real circumstances become more favorable.

Cultural discriminations towards EVs are acknowledged, as people usually doubt their ability to withstand high temperatures of various conditions or the safety of a battery. Also, other people view the silence of engines as a sign of a lack of power, which is contradictory to the conventional ideology that connects vehicle power to noise and vibrations. According to industry players, it is

possible to raise the popularity of EVs with the help of the word of mouth and personal experience that would assist in changing the perception of people. A good example is that the preconceived doubt over hybrid cars in Pakistan has faded and will evolve as more people start using them; the same thing is bound to happen to EVs with increased awareness.

To make the movement between awareness and adoption, certain players in the industry suggest establishing cooperation with ride-hailing and logistics providers so that EVs could receive publicity and normalization faster than other methods of advertising would. Nevertheless, players in the industry would be reluctant to fund educational campaigns on their own but would rather seek government or media assistance. Nevertheless, other players are using awareness campaigns, including protests and auto shows, on the assumption that influential people and corporations can have a positive impact on the general opinion, particularly when it is reinforced with social media.

To conclude, the sector understands that the lack of consumer awareness and cultural resistance prevents the adoption of EVs, which have been determined in the socio-cultural factors in previous studies. Nevertheless, they view these barriers as a bigger market development process. Stakeholders insist on the development of visible success stories and specific awareness campaigns, particularly the focus on fuel savings, though they insist that the enhancement of affordability and access will be more effective in modifying the perceptions of the consumers. The current strategy that they follow is to tackle practical barriers initially and develop the positive consumer attitudes by means of the EV demonstrations which specifically address certain issues.

Academia Perspective

Consumer awareness and cultural attitudes play crucial roles in the adoption of electric vehicles (EVs) according to academic and social research. While cost remains the most significant determinant, psychological and cultural barriers are becoming increasingly pertinent, especially as cost-related issues are gradually addressed. A notable case study identifies Pakistani consumers' limited knowledge about EV technology, resulting in reservations regarding key areas such as range, reliability, maintenance, battery life, and resale value, many of which stem from a lack of information and exposure to EVs.

Research indicates that consumers are not sufficiently informed about the advantages of EVs, fostering skepticism towards new technologies that differ from traditional internal combustion cars, which have historically symbolized status and achievement. This skepticism is compounded by the perception of EVs as luxury items or quirky purchases rather than mainstream options. Despite rising environmental awareness, practical and economic considerations dominate consumer choices, with many viewing advanced technologies like EVs as risky.

To address these challenges, scholars advocate for enhanced consumer education, emphasizing the importance of desensitization campaigns led by reputable organizations such as automobile associations, environmental NGOs, and technology influencers. These campaigns aim to dispel myths and educate the public about the benefits of EVs, including operational cost savings and ease of maintenance. Pilot projects and demonstrations, such as integrating electric buses into city transport or promoting branded taxi services, are highlighted as effective strategies to increase direct interaction with EVs, enabling firsthand experiences.

The theory of diffusion of innovation suggests that as more individuals encounter EVs, cultural resistance may wane. Historical comparisons to the adoption of solar panels and smartphones illustrate this potential shift, which is supported by emerging scholarship indicating that consumer awareness and acceptance are manageable challenges despite existing cultural barriers. Interviews emphasize that as global and local adoption of EVs rises, public perception may evolve favorably, accelerating the acceptance process.

There is a consensus among stakeholders that achieving initial milestones is vital for changing public attitudes toward EVs from experimental to mainstream options. The introduction of electric motorbikes and buses into the market is seen as a strategy to foster acceptance. While industry stakeholders advocate for affordability and accessibility as primary focuses, they recognize the necessity of raising awareness concurrently. It is clear that these approaches are intertwined; improving consumer awareness is essential for the overall facilitation of EV adoption. However, it is equally important to correct misconceptions about EVs and emphasize their advantages, ensuring that as economic conditions and infrastructure improve, consumers are prepared to transition to EVs.

5.6 Theme 6: Local Industry Development vs. Import Dependence

Government Perspective,

A local electric vehicle (EV) industry is among the long-term objectives of the Pakistani government, which implies that it must introduce practical limitations, on the short term. However, now, the emphasis is on imported EV cars and batteries, which is a threat to making Pakistan a net importer of EV technologies. This addiction has an adverse effect on foreign exchange reserves

and a restriction in job creation and development of local industry. Even though the government has established localization targets in its EV policy documents of 2019 and the draft of 2025-2030, including a greater proportion of locally assembled EVs by 2030, little has been done in terms of achieving those targets.

Another major obstacle to localization has been the unwillingness of established auto manufacturers to make investments in EV production. This has put a block to the local development in the face of government attempts to promote EV production with duty-free parts and some few duty-free imported kits to trial. Even though these incentives led to the licensing of about 20 EV assemblers which are mainly concerned with two- and three-wheelers, majority of these businesses are still in an infancy stage and the country cannot manufacture vital material such as batteries, motors and power electronics.

To fill this void, the government came up with the New EV Policy 2025-2030 that focuses on the local production by conditioning the consumer incentives, including subsidies, on minimum local value addition. Such an arrangement will encourage businesses to assemble or produce EVs in Pakistan. It augments other prior supply-side incentives established in its previous industrial policies, including the Auto Industry Development and Export Policy (AIDEP 2021-26), which is tax relief on the locally produced innovative automotive technologies. Other incentives are zero-rated importation of production machines and tax holiday to the companies that set up battery assembly plants.

In addition, the government intends to create a National EV Innovation Fund that grants should be offered to local research and development on EV technologies, a criticism has been made in the past that the government does not support indigenous innovation. In partnership with universities

and technical schools, skill development programs are also being implemented to train engineers and technicians specifically to work in the field of EV maintenance, overcoming the lack of skills due to the absence of early training programs. The current trends also involve the development of an EV center of excellence with the help of National Electric Vehicle Council (NEVC) to conduct research and technical training and new policies on battery recycling and wastage to support the local recycling industry.

In general, localization is considered essential in the long-term sustainability, financial stability, and employment. Although improvement is considered slow and slow, the governmental role is dominant to create the environment that would lead to the investment in local EV production by the existing automotive companies and new market entrants. The policymakers admit the past failures of funding domestic industries, and current reforms of policies are made to correct the failures and emphasize on providing conditions to localization and not imposing strict demands redundantly.

Industry Perspective

The critical opinions of industry representatives in Pakistan underscore a stark contrast to government views, advocating for a transition from an import-dependent model to a self-sufficient electric vehicle (EV) industry. This ideological divide is a central theme in stakeholder debates, as industry players argue that reliance on imports hampers technological growth and economic development. They call for locally manufactured components to compete internationally, emphasizing that the current focus on importing finished vehicles or kits limits the economic benefits and exposes the country to exchange rate fluctuations and supply chain disruptions. Past

import experiences with solar panels and mobile phones highlight the importance of building local manufacturing capabilities for EVs.

Industry experts note a persistent lack of indigenous manufacturing and technological development within Pakistan's EV ecosystem, with minimal local production of critical EV components. They criticize the original EV strategy for lacking support for domestic manufacturing and advocate for policies that concentrate on key parts, such as motors and batteries. This approach is framed as essential for establishing a sustainable EV market, as continued dependence on imports would further destabilize the economy.

Comparative examples, such as India's localization policies that incentivized domestic production, illustrate potential pathways for Pakistan. Weak industry-academia collaborations hamper innovation, with stakeholders noting the need for better coordination to foster research and development. While some small partnerships exist, they require formal organization and funding, with calls for government initiatives like special innovation funds.

Several market segments present competitive manufacturing opportunities for Pakistan. Targeting the two-wheeler market is particularly promising, given the country’s annual production of millions of motorbikes, which could be electrified with relative ease. Local suppliers could pivot from traditional motorcycle parts to those needed for electric models, with further opportunities identified in electric rickshaws and buses.

The narrative aligns with key research questions addressing barriers to sustainable EV adoption and the need for policy reform. Industry stakeholders emphasize a clear urgency related to import reliance and the absence of incentives for localization, often criticizing current policies for

favoring imports. Proposed strategies include production-based incentives and stable tariff structures to attract investment and joint ventures in electric manufacturing.

In summary, the industry advocates for self-reliance in the EV supply chain, viewing it as both a significant economic opportunity and a prerequisite for successful EV adoption. A continued reliance on imports is framed as a risk to cost stability and external vulnerability. The emphasis is placed on timely implementation of new policies focusing on localization to ensure that Pakistan develops a robust domestic EV industry, transforming its economic landscape.

Academia Perspective

The significance of localization in Pakistan's electric vehicle (EV) transition is emphasized by academic experts, highlighting its role in achieving long-term sustainability. Scholars agree that localizing EV production is crucial for maximizing benefits, asserting that domestic vehicle and component manufacturing will enhance job creation, spur innovation, and lower import costs, aligning with environmental and economic goals. Criticism is directed at the initial EV policy for neglecting supply-side readiness; it set adoption targets without supporting local production or research. This oversight stems from the slow adaptation of existing auto manufacturers and a policy focuses on demand rather than supply.

Academics advocate for partnerships, particularly with advanced nations like China, to facilitate domestic assembly and build local expertise through training in relevant engineering domains. The potential for a circular economy in the EV sector is discussed, proposing that developing battery recycling could create an industry that serves both economic and environmental needs. The policy

should incorporate sustainability principles to preempt future challenges and leverage opportunities in recycling and renewable energy sectors.

Stakeholders recognize the importance of a domestic EV industry, with varying priorities identified; the industry seeks urgency, while government conservatism aims to attract foreign investment. Effective policy frameworks, such as the Multi-Level Perspective (MLP), are essential to synchronize industrial and EV policies. The scholarly discussion stresses the necessity of enhancing local manufacturing capabilities to avoid an unsustainable import-driven strategy and dependence on foreign markets, particularly concerning China.

Concerns regarding geopolitical implications of reliance on imports are outlined, particularly the risk of dependency on China for EVs and batteries. The discussion also reflects on national resilience through local capacity building, avoiding the pitfalls of past import dependencies in sectors like electronics. Ultimately, scholars assert that the EV transition signals a transformative shift in Pakistan's industrial landscape rather than mere technological updates. With improvements made to local manufacturing policies, the key measure of success will be the extent of domestic EV production over the next five to ten years, seen as vital for a self-reliant and economically sustainable e-mobility future.

5.7 Theme 7: Policy Continuity and Learning

Government Perspective

Governmental representatives focused on the fact that the policy on electric vehicles (EV) is changing and that policy continuity is required during a change in politics. A high-ranking policymaker said that the National EV Policy 2019 was followed by the draft National Electric

Vehicle (NEV) Policy 2025-2030 which incorporates experiences of earlier implementation stages. The authorities affirmed that the 30% by 2030 goal was still valid and that the process towards this goal would be accelerated. These are the direct measure to the stakeholders concerns on the possible abandonment of the policies, or radical changes during the change of administration.

According to (G1) and other officials, the policy of Pakistan is based on the initial one. As an example, the 2025-2030 policy reinforces goals and presents new institutions, such as the EV Steering Committee and more incentives instead of dumping the 2019 vision. It was acknowledged by the officials that the progress had slowed down between 2019 and 2021, and some measures were not taken, including the conversion of compressed natural gas (CNG) stations into EV charging stations. The novice policy has now been fronted as a sign of institutional learning and correction of the course.

Government stakeholders outlined policies to maintain the stability of policies such as the review of policies after every 2 years which should be done in 2026, 2028, and 2030 to see the progress and change implementations where they are required. The reviews are also aimed at creating a feedback mechanism that facilitates the process of constant learning. The government allows the industry, provincial representatives, and academia to be part of the policy committees to expand the ownership of the policies and reduce the chances of changes in policy. Stakeholders added that roll takeovers in the past were harmful and stressed the need to prevent such upheavals.

The government officials used the example of the zero goods and services tax (GST) on EVs, which remained despite the changes in government, as an indicator of the increasing agreement that some of the pro-EV policies had to be maintained. The official stance indicates a more serious learning in terms of initial implementation difficulties. The problem gap that is identified in RQ2

is that the policy continuity and learning are not institutionalized, and this policy framework enables the organization of such continuity.

Industry Perspective

Participants in the industry have denounced inconsistency in policy and lack of follow-through, which have adversely affected the EV industry. They noticed that the momentum slowed following the policy launch in 2019 because some of the incentives were removed because of financial limitations and some of the promised programs had not been realized completely. According to (I3), the idea of converting compressed natural gas (CNG) stations to EV charging stations was not implemented, and this fact adds to the view that policy initiatives are not long-lasting.

The industry stakeholders interviewed indicated that they had reviewed the draft of the new policy and had cautious optimism about the inclusion of lessons learned on past cycles of the policy. They also accepted the fact that the 2025-2030 policy does not change the 30% goal but introduces accountability tools, including the EV Steering Committee, and this signifies the continued commitment of the government. Experts in the industry observed that the policy has addressed past deficiencies and has proven to be trying to put coherent approach, such as harmonization with the energy and industrial policy which had never been combined before.

The representatives of the industry also are not confident yet and demand the demonstration of the stable policy realization for a long time before they can state their full confidence. They also stressed the need to be committed in the long term, saying that a policy should be changed every short period to thwart long-term planning. As an example, the EV component import duties have been changed every year, with the result being uncertainty. The players in the industry also pushed

bipartisan deals to make sure that the policies remained consistent through political changes and also suggested legislation to support the important aspects of the policies like tax breaks to make them more permanent.

One of the representatives of the industry related the policy consistency to the credibility of the international market arguing that frequent changes of the policies deter foreign investment. They have given examples of how changing incentives discourage companies to invest. Although players in the industry were at fault with the earlier discontinuities, the new policy has been seen as an affirmative corrective action on the part of the industry players. They usually endorse projects that reflect institutional learning like a pilot review and want guarantees that the commitment will be maintained to record concrete outcomes. In the case of industry, policy continuity is viewed as a major enabler, and their lack is the major obstacle.

Academia Perspective

The continuity of policies and iterative learning in sustainability transitions, particularly in e-mobility, necessitate stable, long-term policies as emphasized by scholars and policy analysts through the lens of transition management theories. The need for such policies arises due to the multi-year and multi-sectoral nature of required changes. One scholar highlighted the Multi-Level Perspective, suggesting that policy courses should be maintained even during economic downturns or transitions in government, with early electric vehicle (EV) policies criticized for lacking a binding framework and institutional memory.

The initiatives aimed at institutionalizing policies, such as the establishment of the EV Steering Committee and international climate collaborations, are recognized as significant advancements.

Scholars advocate for a 'learning by doing' approach, circling back to policy development to address identified gaps. One recommendation is to implement a prudent recovery strategy with formal reviews and revisions anticipated in 2025. Additionally, they stress the importance of pilot projects and regular data collection to facilitate adaptive management, supported by interim targets and a readiness to modify incentives or regulations. The incorporation of Key Performance Indicators (KPIs) and monitoring systems is also highlighted.

Academics acknowledged the value of learning from international experiences while noting the critical need to consider local contexts. Their key principles include avoiding frequent policy reversals and ensuring follow-through, which involves institutionalizing learning through annual progress reports and independent policy reviews. This systematic feedback mechanism allows for policy corrections without undermining overarching strategies.

The academic perspective aligns with industry and government views on the necessity of policy consistency and long-term commitment. Scholars argue that transitioning to EVs cannot succeed on a short-term, stakeholder-based approach; instead, it requires sustained support. This comprehensive view underscores the importance of developing flexible policy documents that can adapt and thrive over time. A shared acknowledgement among stakeholders regarding the importance of policy stability signals potential momentum against policy abandonment. Despite ongoing continuity challenges in Pakistan, the EV sector's potential shines through, as it presents opportunities for stakeholder involvement, establishment of long-term institutions, and a sustained focus on future perspectives.

Recent developments indicate a shift towards a more long-term, dynamic approach to EV policy, prioritizing institutional learning over reactive policy resets. These findings lay the groundwork

for discussions on barriers and gaps, leading into potential solutions and are elaborated upon in the subsequent chapter. Chapter 5 will address the research questions in a descriptive manner, setting the stage for insights into both theoretical and practical implications.

Chapter 6:

Discussion

6.1 Introduction and Overview

This chapter methodically synthesizes empirical findings with a theoretical framework to address research questions related to the e-mobility shift in Pakistan. Utilizing the Multi-Level Perspective (MLP) framework, it identifies challenges and gaps at various systemic levels - macro (landscape), regime (meso), and niche (micro) - impeding electric vehicle (EV) adoption. The analysis recognizes that macro-level issues such as economic instability and energy supply uncertainties inflate EV costs and threaten electrification efforts. Additionally, regime-level obstacles, including fragmented governance, inadequate infrastructure, and regulatory inefficiencies, hinder industry change. Niche-level barriers encompass consumer financing challenges, limited awareness, and insufficient local innovation, reinforcing the interdependencies indicated by the MLP model.

The chapter critiques the 2019 Electric Vehicle Policy, noting significant shortcomings: lack of coordinated oversight, inadequate safety regulations and infrastructure investment, minimal incentives, limited support for local development, and absence of adaptive management practices. These weaknesses highlight the need for coordinated institutional mechanisms, technical standards, infrastructural goals, and enhanced financial incentives in the forthcoming National Electric Vehicle (NEV) Policy 2025-2030.

Key policy implications advocate for a multi-level approach that concurrently addresses macroeconomic stabilization, governance improvements, infrastructure development, and niche

innovation. Specific gaps identified through Research Question 2 emphasize the necessity for targeted interventions, such as establishing a coordination body, expanding infrastructure funding, and promoting local innovation. It is crucial that policy responses are tailored to the unique barriers identified in Research Question 1 to ensure effective intervention.

The chapter underscores the importance of flexibility and continuous learning in policy implementation, recommending ongoing evaluations to adapt to changing market conditions and technological advancements. The subsequent sections will present findings systematically, initiating with macro-level analysis, followed by meso and micro levels, thereby linking policy weaknesses with actionable suggestions across these tiers.

6.2 Macro-Level Factors: Landscape Pressures Shaping the Transition

The overall economic and energy situation also influences the transition to electric vehicles (EV) in Pakistan, at the macro level. The macroeconomic instability and energy supply restrictions are determined as the major obstacles to EV adoption in the analysis. These structure forces determine the context on which other influencing factors act. The socio-technical transitions theory argues that landscape factors are typically beyond the direct control of the niche or regime actors but define the extent of possible change. In the context of Pakistan:

a) Macroeconomic Uncertainty: EVs and imported technology have become costly due to high inflation and a fluctuating currency, compromising affordability interventions and making them more expensive to the consumers and government. As opposed to literature which usually presupposes stable economies, the unstable macroeconomic situation in Pakistan has nullified the effects of the government incentives, which explains the continued affordability issues.

b) The overall net effect of electric vehicle (EV) policies and incentives is counteracted by persistent macroeconomic instability, in specifically inflation and currency volatility. This dynamic poses a serious hindrance in affordability by consumers and the government.

c) Energy Supply and Carbon Intensity: Low reliability and environmental benefits of electric vehicles (EVs) are due to frequent power outages and the reliance on fossil fuels in Pakistan. The grid unreliability enhances the range anxiety, and generation of electricity with coal and oil cancels the possible benefits on the environment. The likelihood of EVs depends on stable energy supply and the timely transition of the grid, which is hindered by the chronic energy crises and insufficient modernization of the grid, which explains the need to combine EV and renewable energy policies. Mass adoption of EVs cannot be as high without a stable and clean energy supply. The environmental and economic benefits of EVs can be achieved when the grid is powered by cheap solar energy.

The macro-level analysis reveals that the electric vehicle (EV) transition should be insulated against the economic fluctuations. It is recommended that policymakers should hedge imports of EV and seek climate finance. There is a need to incorporate EV policy with the wider environmental and sustainability goals. Introducing an EV fund that would be financed by multi-year, possibly international green funds would be able to maintain incentives when fiscal strains take place. The ability to generate EV targets in alignment with national and international climate obligations, including Nationally Determined Contributions (NDCs), could help ensure that the policy can be reinforced in order to continue to be funded amid budgetary constraints.

These results also prove that the policy of electric vehicles (EV) and effective energy planning need to be closely synchronized. The deployment of more charging infrastructure is not enough,

but Pakistan needs to improve the electricity system, as well as to increase the power of renewable energy sources, so that EVs can be not only convenient to use but also useful to nature. The NEV 2025-30 draft policy considers the issues with special EV tariffs during off-peak and encourages the use of solar charging, which by targeting macroeconomic limitations specifically addresses these challenges. The success of EV adoption is proven by international evidence that has shown that stable economies and strong investments in the power industry are the key to successful EV adoption.

Economic and energy issues in Pakistan are macro level factors that are a major impediment to the implementation of electric vehicles (EVs). These factors have hampered the success of the cost cutting initiatives and hampered consumer interest because of grid constraints. The future EV plans should involve the use of contingency plans in case of economic and energy turmoil such as finding concessional financing when there is a shortage of funds and use of excess night electricity generation. This strategy is called the landscape buffering in transition management, and it is crucial in minimizing the macro-level risks and the success of the EV transition in Pakistan.

6.3 Meso-Level Factors: Regime Barriers and Systemic Misalignments

On the meso (regime) level, several entrenched barriers in the transport and energy sectors of Pakistan hinder the innovation of electric vehicles (EVs). Key issues identified include institutional fragmentation, lack of infrastructure, regulatory inadequacies, and resistance from established industry players.

a) Institutional Fragmentation and Governance Gaps: The analysis highlights insufficient coordination among agencies as a critical barrier that obstructs the transition to EVs. Without a

designated lead agency, responsibility for EV policy has become dispersed among various bureaucracies, which inhibits coherent policy-making. The formation of an EV Steering Committee and National Electric Vehicle Council (NEVC) aims to enhance coordination and rectify these governance gaps, recognizing the need for a clearer structure to drive a successful EV integration strategy.

b) Insufficient Infrastructure and Standards: The present lack of charging infrastructure and underdeveloped EV regulations contribute to regime inertia. The legacy petrol system has resisted necessary adjustments to accommodate EVs due to regulatory biases and bureaucratic shortcomings. Pakistan's slow evolution toward EV adoption reflects delays in organizational standards and regulatory frameworks. The NEV 2025-30 plan proposes new standards for infrastructure, including the Combined Charging System 2 (CCS2) connector, and emphasizes compliance and development of testing laboratories to rectify these deficiencies.

c) Resistance from Incumbent Industries: Established automakers and bureaucratic structures exhibit a reluctance to fully embrace EVs. Their resistance is fueled by the desire to maintain current market positions, resulting in conservative policies and delayed incentives for EV adoption. Policy-makers aim to engage these incumbents by linking subsidies to local production and establishing joint industry councils to leverage their economic interests in EV manufacturing.

The interplay among these meso-level factors reveals a systemic misfit: institutional silos, inadequate infrastructure, and industry resistance collectively form a dynamic feedback loop of inertia, hindering progress. This situation is exemplified by the necessity of infrastructure advocacy and the inertia stemming from current market conditions. Comparative literature

provides insights into effective EV policy, noting that proactive standards and coordination—seen in countries like China—facilitate technology adoption.

The case study of Pakistan illustrates that the implementation of new regulatory frameworks, incentives, and institutional leadership, alongside the unification of policy efforts across various sectors, is vital for overcoming regime failures and catalyzing EV adoption. Continuous reforms, emphasizing the integration of policy, institutions, and incentives, are essential for a successful transition and ultimately address the limited initial performance in EV technology adoption.

6.4 Micro-Level Factors: Niche Dynamics and Actor Perspectives

At the micro level, it is important to examine the views and issues of the end-users, small business organizations and grassroots innovators to determine the obstacles that exist in the adoption of electric vehicles (EVs) in Pakistan.

a) Large initial expenses are a major challenge, which can be explained by macroeconomic factors and the infantile phase of the adoption of electric vehicles (EV) in Pakistan. There is no economies of scale and little local production power which keeps prices high. This finding can be explained by the diffusion theory which Rogers developed and which states that the initial users of a new technology pay more and that the mass adoption is contingent on the price cuts. In the recent past, the policy response by Pakistan which was confined to small tax cuts was not enough to facilitate a reduction in this gap. The introduction of subsidies on 2 and 3 wheelers and introduction of loan schemes are now pointing out to more serious assistance. The subsidies play a very vital role in allowing the niche competitors to compete with the existing market choices. As a result, it has been adopted in high-end segments, which omit the average consumers. This

evidence shows that focused measures including subsidies and finance systems are necessary to expand the participation in the market. Cost is recognized as the major impediment by the stakeholder consensus, and it is important that the intervention and the improved efficiency of the policies should be achieved.

b) The low awareness and cultural resistance are also a major impediment to EV adoption. Among the countries, Pakistan has a rather skeptical attitude towards new technologies, and the social status is very often associated with the size of the engine and the fear of unreliability. A successful transition should be achieved through social and cultural acceptance that involves the social and cultural aspects, not just technical and economical factors. This analysis has pointed out that cost is the major barrier; once this is dealt with then awareness and acceptance will be enhanced. Even those with the means to afford an EV are reluctant because of the unawareness and insufficient confidence on EV technology. This emphasizes the role of non-coercive measures like community educational campaigns, demonstrations of technologies and the encouragement of reputable heroes. At the micro-level, there is low demand even in the presence of EV models, which is most likely linked to a lack of information and trust. Social legitimacy is just as essential to establish as is cost barriers. Therefore, there is need to create awareness, public showcases, and pilot projects to enhance knowledge and the creation of positive perceptions. This strategy is backed up by academic literature, where the importance of storytelling and network-building in the development of niche innovations are highlighted.

c) There is not much local innovation in the electric vehicle industry, and there are not many locally-based startups or research and development efforts. Consequently, the niche does not have internal followers and supporters. Most EVs are imported, with few local assemblers of e-bikes

operating. This poor entrepreneurial visibility has discouraged the formulation of successful policies, unlike situations where the local companies are vigorous in lobbying in their favor. Pakistan has done very little in terms of niche experimentation and grassroots innovation that are also required to learn and develop momentum. Respondents with academic background reported that institutional linkages and support were poor. Recent government initiatives are focused on encouraging local innovation by funding, incubation, and academic-industrial partnership. The stakeholders have demanded that an innovation fund and skills development programs should be established. The initiatives will produce locally appropriate solutions including retrofitting of kits on rickshaws, which will meet certain demands and cost limitation.

An analysis of micro-level data shows that the low rate of the EV transition in Pakistan was due to the lack of niche support, which included high prices, weak protection, low knowledge, and weak domestic network. This discussion answers Research Question 1 (RQ1) directly since it explains why consumers and small actors failed to change their behavior under these circumstances. As far as Research Question 2 (RQ2) is concerned, the results reveal that micro-level enablers should be covered by the policymakers to make EVs more attractive and accessible to people. The new policy being more focused on targeted rebates and loans and raising awareness and pilot projects is a major change to the previous policy of broad cuts in taxes that only a few high-end buyers were able to notice and that no one in the general population was paying attention to. These direct inducements and observable efforts have been deemed as the key to mass adoption as a strategic shift towards holistic micro-level support.

Going back to theory and literature, landscape, regime and niche policy alignment is a key requirement in an effective transition effort of which is evidenced by the changing policy mix in Pakistan.

The broad support of micro-level barriers among stakeholders highlights the fact that the acceptance of EV in Pakistan is not based on theoretical reasons.

The micro-level approach proves that individual decisions and opinions are at the center of achievements of the EV transition in Pakistan.

6.5 Comparative Analysis

This can be explained through a comparative study and analysis of other Asian countries regarding the challenges confronting Pakistan in the transition to electric vehicles (EVs). Although affordability and availability of infrastructure are issues that plague most of the developing markets, Pakistan has a comparatively severe lack of systems. This analogy places Pakistan in the context of larger regional tendencies, especially the impact of stable policy coverage and industrialization promotion and determines the particular economic and governmental barriers. Peer experiences highlight the need to have sustained incentives, infrastructure coordination, and loose policy frameworks.

6.5.1 India

India has developed because of long term policy programs. However, the amount of electric vehicles sold in 2024 accounted to some 100,000 vehicles, and they comprised 2 percent of new vehicles. All-inclusive initiatives like the Faster Adoption and Manufacturing of Electric Vehicles

(FAME) scheme offer direct purchase subsidies as well as encouraging local production. In 2024, India had thousands of public charging stations and several local EV models, but Pakistan had few chargers and no local EV assembly.

6.5.2 Thailand

It is through the intensive incentive programs that Thailand is projected to reach 13 percent of new vehicle sales as electric vehicles by 2024. This result shows that the development of the EV market may be increased many times with the help of constant policy assistance and specific fiscal actions.

6.5.3 Vietnam

The market of electric vehicles in Viet Nam is still rather small, but its growth is fast year by year, and the sales are increasing twice or even three times as compared to a minimal level. This is growing out of supportive policy measures and growing supply.

6.5.4 Indonesia

The market of the electric vehicles in Indonesia is still at its initial stages, and its sales are increasing two or three times in terms of magnitude. This trend shows the beginning of momentum with incentives and industry policies starting to take a toll in the growth of the market.

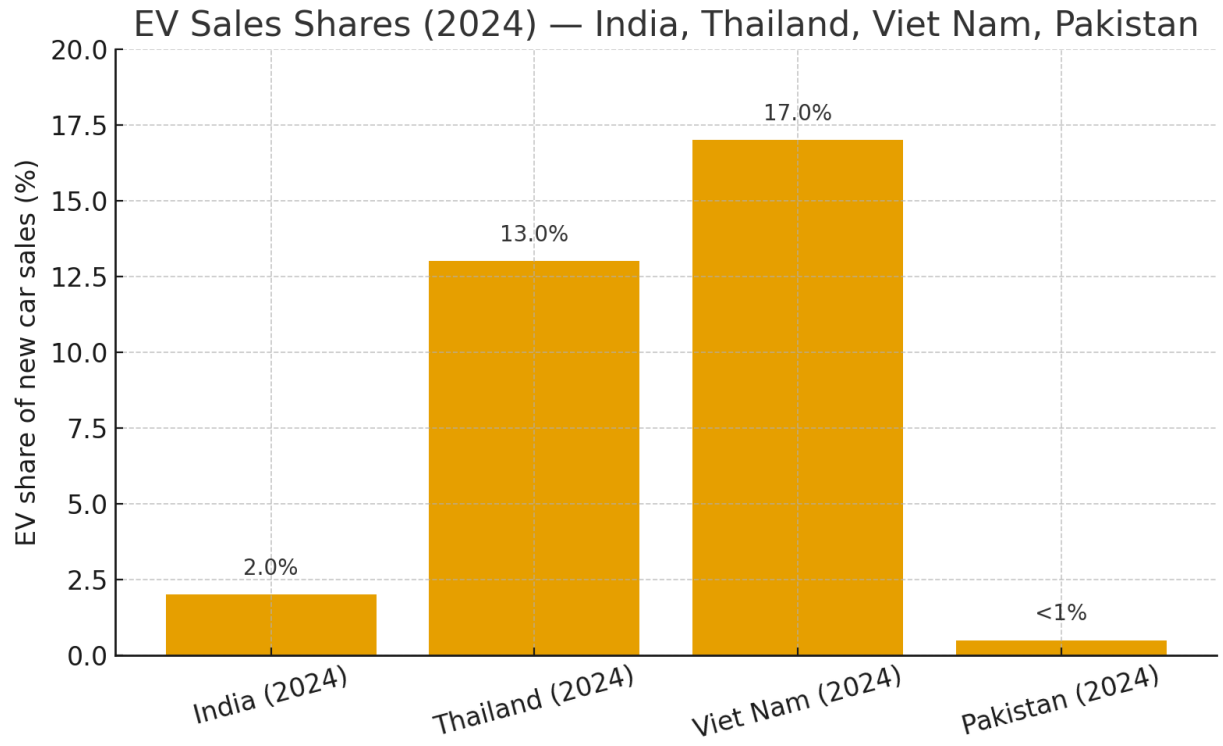
6.5.5 Pakistan

By contrast, the sales of electric vehicles in Pakistan are insignificant and constitute less than 1 percent of the new vehicles sales. The current policy measures are still fledgling and only a few

charging stations and no domestic EV manufacturing can be identified within the time frame in question.

Affordability and infrastructure constraints are rampant issues among peer nations. Nonetheless, the performance of Pakistan is significantly lower than that of the countries that have balanced policy support and the development of the industry. These comparisons with international experience support the suggestions of long-term incentives, infrastructure associations, and flexible policy-making strategies.

Fig. 6.1: EV sales of developing countries



Reference: Author owns illustration sourced from Global EV Outlook 2025

Table 6.1: EV sales and policy highlights of developing countries

Country	EV Share of New Car Sales (2024)	EV Policy Highlights
Pakistan	*<1%* (very limited uptake)	Initial tax waivers in 2019 policy; new 2025–30 draft policy setting 30% by 2030 target, but implementation weak (fragmented governance).
India	~2%	No direct car subsidy (until recently); strong 2/3-wheeler subsidies – **FAME II** program for e-bikes/rickshaws; production incentives for EV manufacturing.
Thailand	~13%	Generous consumer incentives and tax breaks; EV assembly promoted via investment perks; robust charging infrastructure in place (policy-supported).
Vietnam	~17%	Fast growth driven by **VinFast** EV production; import duty exemptions and incentives to attract FDI in EV sector; national EV roadmap targeting 1 million EVs by 2028 (announced).

References: Global EV Outlook 2025 (sales data); IEA EVI data; National policy documents (FAME II, etc.).

6.6 Synthesis:

Bridging Barriers and Policy - To a Coherent Transition Strategy. This chapter will change the focus of the analysis of the micro-level barriers, and policy dynamics, to the synthesis of the findings at all levels of analysis. The second discussion explains how these insights can be used in creating a single transition strategy.

In-depth examination shows that the inability of Pakistan to adopt EVs rapidly is due to the non-alignment of various factors, such as problematic external environment, gradual policy change, and lack of encouragement of new market actors. All the levels of analysis were a source of barriers. The next steps should be done through the policy-based approach where the better the policy is at any level, the more it strengthens the other levels.

The current stakeholder actions and the NEV 2025-30 analysis conducted recently show that there is a shift towards the holistic strategy.

a) Landscape Integration: Pakistan is now incorporating landscape pressures into its policy by aligning EV policy with climate commitments and pursuing international funding (making climate obligation a resource and economic need external support). There are also other interventions like special tariffs when off-peak charging EVs to ensure that the EV rollout is linked to the dynamics in the power sector so that they can leverage an existing landscape feature (excess night generation) to their benefit.

b) Regime Reform: The formation of bodies of coordination, the more regulatory framework of the draft (including standards) and incentives in the industry are responsively reforming the regime. This deals directly with governance and infrastructure barriers - e.g., when the National

EV Steering Committee is functioning well, we will not experience the same fragmentation problems, when standards are implemented, the consumer and investor confidence will be in Niche Support: The introduction of new subsidies, financing mechanisms, awareness campaigns, and innovation funds now takes into consideration the support in the niche that previously was not well supported. The measures should help both consumers and entrepreneurs to enter the market, leading to a greater number of EVs and a stronger need in terms of supporting infrastructure and policy interventions. It is expected that this process will cause positive feedback effects assist consumers and entrepreneurs to join the market which will result in more EVs on the road and more infrastructure and policy support demand positive feedback.

This method is associated with the idea of Strategic Niche Management (SNM), that focuses on the essence of developing niches based on the expectations, networks, and learning. Pakistan currently is putting these principles into practice by setting more specific targets, including committing to the 30% adoption target by 2030 with concrete measures, broadening networks of stakeholders, provinces, industries, and academia, institutionalizing learning, through bi-annual policy reviews and feedback of pilot projects. This is in line with best practices set by SNM.

Putting the efforts of Pakistan in a comparative note indicates that major transition to electric vehicles in the world has been based on concurrent demand-side incentive, investment in infrastructure, and facilitation policy. The first strategy that was applied by Pakistan was disjointed as it had fewer incentives and lacked good infrastructure and coordination, which was not effective. The recent change to a more comprehensive policy mix that is also indicative of the most successful experience of the global practices will bring better results. Norway is a successful case example because of the mixture of incentives, publicly available charging infrastructure, and the

uniform policy. Even though the situation in Pakistan is somewhat different, the same principle of the coordination of action between the policy levels is vital.

The analysis shows that such barriers as the cost, awareness, and infrastructure are interrelated. Macroeconomic aspects are increasing costs; the limited awareness of EVs only by few vehicles, and the gaps in infrastructure support both. The solutions involve the coordination of policies and actors. This multi-level approach explains low rates of initial adoption and suggests that comprehensive and consistent strategies are required.

As an answer to the second Research Question, namely how the current gaps can be bridged in the future through new policy frameworks, the analysis determines a number of principles that a strong policy framework should have:

a) Cross-sector Coordination: Incorporate all the concerned agencies and government levels in the implementation process (e.g., the NEVC concept, inter-ministerial committees, etc.).

b) Adaptability: Incorporate lessons via build in security checks: Respond to technological/economic changes by building in reviews and updating policy after every 5 years (Pakistan switching to biennial reviews and seeking to revise the policy after 5 years is a positive move).

c) Stakeholder Inclusion: Incorporate industry, academic and civil society input to hone policies (as was done with the 2025-30 policy, which consulted much broader than the first time). This creates an agreement and minimizes opposition.

d) Continuity and Commitment: Indicate long-term commitment (via legally sanctioned goals, perhaps, or multi-year bonuses that investors can rely on) to ensure that the direction of the transition is assured to the private sector and consumers.

e) Comprehensiveness: Discuss infrastructure, incentives, standards and awareness as the measures that go hand in hand with each other (not one by one or in a row).

f) Monitor and Enforce: Establish explicit KPIs (e.g. number of chargers, EV sales, local content) and publicly monitor. And regulate (to impose standards, to assure that the products conform to these standards - by imposing fines or market inspectors).

These values deal with all the significant obstacles. Fragmentation can be overcome by coordination, policy consistency through continuity, cost direct incentive, and so on. All these barriers were indicators of a policy fragment that had been shot down.

Socio-technical transitions theory stresses that there is a necessity to match the developments on every level. The efforts of Pakistan were not such aligned at the initial stages, and this is why the barriers appeared. It is now possible to align with improved policy frameworks, as well as direct support of early adopters, in the event of macroeconomic stability. This interaction will dictate the way of breaking the barriers; a successful transition will require organized macro, regime and niche actions.

The wider implication on other developing states is also remarkable: the example of Pakistan suggests that the introduction of an EV policy cannot be a silver bullet: it should be a part of an overarching transformation project. We have an example of one of our sources giving

recommendations in the context of which he said, piecemeal efforts will not do. The following discussion gives the rationale of that statement and supports it using empirical understanding.

After determining the issues and changing policy responses affecting the EV transition in Pakistan, the research now moves to the interpretation and synthesis stage to the proposition of practical recommendations. Strategic and practical steps to be taken by government, industry, and academia will be given in the following chapters and these insights transformed into a roadmap of quickening EV adoption in Pakistan.

Chapter 7:

Conclusion

To respond to the research questions, the chapter presents the summarization of the views of government, industry, and academia regarding barriers to the adoption of electric vehicles (EVs) and policy gaps. Combined, the two opinions mean that a multi-level strategy is to be employed to achieve the Pakistan EV objectives.

7.1 Government Perspective: Barriers and Policy Gaps

The government's perception is an initial understanding of the problems of electric vehicle (EV) adoption. The government leaders discovered a massive gap between the policy objectives and performance. The 2019 policy set a 30-percent EV objective by 2030, which may be regarded as ambitious and visionary, but in 2023, there was insignificant progress. The causes according to the economists were macro-level factors such as economic instability, high inflation, currency depreciation, fiscal pressure and energy crisis in a form of power blackouts and coal-based grid. This added the improved cost and reduced dependability of EVs. At institutional level, it had overlapping mandates in the ministries that led to poor performance and slow implementation. The charging infrastructure also was poor with dozens of stations laid out in country by 2025 to the added consumer range anxiety. Initial cash requirements were high even after the import duties and taxes were waived and no early rebates and low interest loans also restricted its adoption. The absence of awareness in the population on the EV technology and the cultural propensity towards conventional cars also contributed to the low demand. The dependency on imported EV components was identified by authorities as one of the strategic weaknesses of Pakistan. Overall,

the government stakeholders experienced multi-layered barriers in the form of inadequate economic and energy climate, institutional disintegration, ineffective infrastructure and high cost and low awareness that transformed the policy objectives into the aspirational rather than realistic ones.

7.1.2 Policy Weaknesses (RQ2)

The insiders of the government noted that the original policy had certain underlying vulnerabilities and could not be fully implemented. It was hampered by absence of lead agency: this was because there was no ministry or coordination agency that was to spearhead implementation. Before the day started, there were no EV standards and the general plan of the charging - the infrastructure was largely in the hands of the market forces - and the incentives to the consumer were insufficient. At the time of launch, there were no direct subsidies or financing, the authorities relied on import duties and tax exemptions. The localization aspect was not considered in detail: assembly targets were posted on research, but the policy did not promote local innovation (i.e. no support of local R&D or production). And finally, the policy lacked any formal monitoring/review mechanism, and thus any emergent issues (charger outages, slow uptake) did not get fed back to be amended in time. These shortcomings were quite close to the obstacles. On the positive side, at the end of 2023, they were under consideration: plans draft NEV Policy 2025-30 will establish an EV Steering Committee and goals of the infrastructure, direct purchase subsidies, green financing plans, and local-content incentives. In a nutshell, the government stakeholders determined that the 2019 policy had high goals but it lacked the aspects of coordination, planning and incentives that needed to be occupied.

7.2 Industry Perspective: Barriers and Needs

The industry orientation dwells on attainable market constraints. The industry stakeholders agreed on the identified barriers to a great extent though it was pointed out that the 2030 target was unrealistic in the present conditions. At the macro level, inflation and fluctuations in currency and fiscal uncertainty render EV importations more costly and unimposing investment. Blackouts and the rise in tariffs further add to the bill, and reduce the demand of the customers. Disintegrated governance and bureaucratic obstacles at institutional level implies that businesses must work under different agencies and inconsistent set of rules. The infrastructure issue is one of the largest, as the public charging stations are in most instances the ones located in the largest cities. The first consumer level deterrents are the high cost and the lack of affordable financing of EVs. Awareness issues were seen as less significant by the respondents in the industry who argued that lowering of prices and improved charging infrastructure would trigger demand. Structural tradeoff was also observed to be the use of foreign parts and this has contributed to the continued importation costs. In conclusion, the RQ1 industrial perspective is realistic: the costs of EV implementation are not supported by economic uncertainty and instability, insufficient infrastructure, the complexity of the regulations, high prices in the absence of a local supply chain.

7.2.1 Policy Weaknesses (RQ2)

The initial policies were perceived to miss the targets with support, which was viewed as a failure in the policy by experts in the industry. They noted that the government was massive in objectives but not providing them with physical support. The lack of the mechanism of coordinating the single stops made investors face in contradictory signals. Rewarding was not a long-lasting process - e.g. in one-year financial year the import taxes on EV components were abolished, the next year they

were reintroduced, which damaged trust. The idea to create an EV Steering Committee was embraced by numerous players in the industry as the way out of the issue. They also thought that the charging infrastructure and demand subsidies were not provided: unless there is a clear business case and subsidies, no charging networks would be built by the private companies, thus not much was going on until donor-funded projects began doing so. About consumer incentives, industry reported that the government did not start direct purchase incentives until 2023 (direct purchase rebates, i.e., Rs. 65,000 per e-bike, Rs. 400,000 per rickshaw) - one that they had endorsed. More to the point, they lamented that the 2019 policy was practically not conducive to local production or research and development, thus Pakistan was years away to have a local EV industry. They were glad that the 2025-30 draft has begun to tie subsidies to local assembly, and further to establish an EV Innovation Fund. The industry resolved that the initial policy lacked co-ordination, lacked a uniform implementation, infrastructure, consumer subsidies and local-industry incentives. They are also hopefully cautious of the fact that all these gaps are solvable by the process of ensuring that the policy remains stable and conducive, and also investing in the EV ecosystem, which will see the EV agenda the aspiration become a reality.

7.3 Academic Perspective: Barriers and Policy Shortcomings

The academic school of thought provides a systematic perspective, which places government and industry output into perspective. The scholarly community largely approached the multi-level analysis and explained that Pakistan’s macroeconomic instability is very high and restricts the government funding and consumer demand of EVs particularly because of stagnant inflation rate, fiscal deficits and foreign-exchange crises. The dominance of coal and gas in a generation mix reduces the net environmental benefits, and the EVs, and chronic load-shedding reduces reliability

in charging. At the institutional level, the disintegration was also seen by researchers who observed that since the implementation of the policy in 2019, the absence of targets enshrined in law led to the inability to feel any improvement after significant advocates of the policy went out of office. The latest moves such as the establishment of an EV Steering Committee and EV goals alignment with climate commitments were regarded as the steps towards the more stable state of affairs. The researchers also pointed at the need to enforce it, stating that the absence of strict standards predisposes a firm that has already established itself in place not to change. Data provided by researchers indicated the problem of inequality in infrastructure because it is anticipated that the number of public chargers would reach no more than 20 by 2025, and the social acceptance issues were present. They were labeled as a nexus of correlated variables, which included cultural disposition to use engine energy and a lack of EV experts in training, which negatively affects the adoption of EVs. Overall, academics view the barriers to be systemic and supportive to each other, which justifies the necessity to possess a complex strategy.

7.3.2 Policy weaknesses (RQ2)

The original policy of EV was interpreted as an inadequate requirement in the academic realm. The major criticisms were that it was siloed - not linked to a broader energy, industrial, or climate strategy - and lacked an adaptive management strategy. The policy and pilot projects were not officially reviewed and, thus, early experience could not be applied to make changes. They have found that the initial outreach and education campaigns were scanty, which is not the case after taking into account the social barriers that were identified. Scholars praised the 2025-30 draft with its 2-year review and KPIs as a step toward more learning-oriented one. They also embraced the current trends in accordance with their recommendations such as introduction of EV content to

university schools and the creation of a proposed Center of Excellence. In general, the results of 2019 policy were reported to have high objectives but did not implement the full set of multi-level actions, which results on policy gaps are quite consistent with the academic diagnosis.

The general consensus of the stakeholders is that the general process of electric vehicle transition in Pakistan has tremendous potential yet it is curtailed by the economic, institutional, infrastructure, and consumer level barriers. The policy of 2019 has been initiating the ball but has left quite a gap regarding the coordination, planning, incentives, and support of the domestic industry. In the scenario of RQ1, the obstacles are at the macro, meso, and micro levels. There were poor policy mechanisms in the case of RQ2 which were policy guided. The new 2025- 30 policy plans to correct these shortfalls by addressing them through the better coordination, technical standards, infrastructure investment and incentives. Close cooperation between the government, industry and academia is needed to make sure that EV promises are turned into reality. The multi-level solution continues to be needed.

Chapter 8:

Policy Implications & Recommendations

To increase the pace of e-mobility in Pakistan, the process needs a gradual approach, where short-term obstacles are overcome and the long-term change is supported. Recommendations will be put together according to implementation time: short-term (1-2 years), medium-term (3-5 years), and long-term (after 5 years). Such a framework guarantees a priority to urgent actions and facilitates the structural reforms as well as continuing initiatives. All the recommendations are based on the data on interviews and supported either by the situation in Pakistan or similar settings.

8.1 Short-Term (0-2 years):

Enabling institutions: through high impact, targeted actions, start the adoption of electric vehicles (EVs).

a) Create National Electric Vehicle (EV) Coordination Council, which is the main agency to coordinate policy. Create an inter-agency mechanism of the climate, industry, finance and energy ministries to enforce and oversee the EV policy on both federal and provincial levels. The council will deal with institutional fragmentation and harmonization of standards, incentives, and initiatives throughout the country.

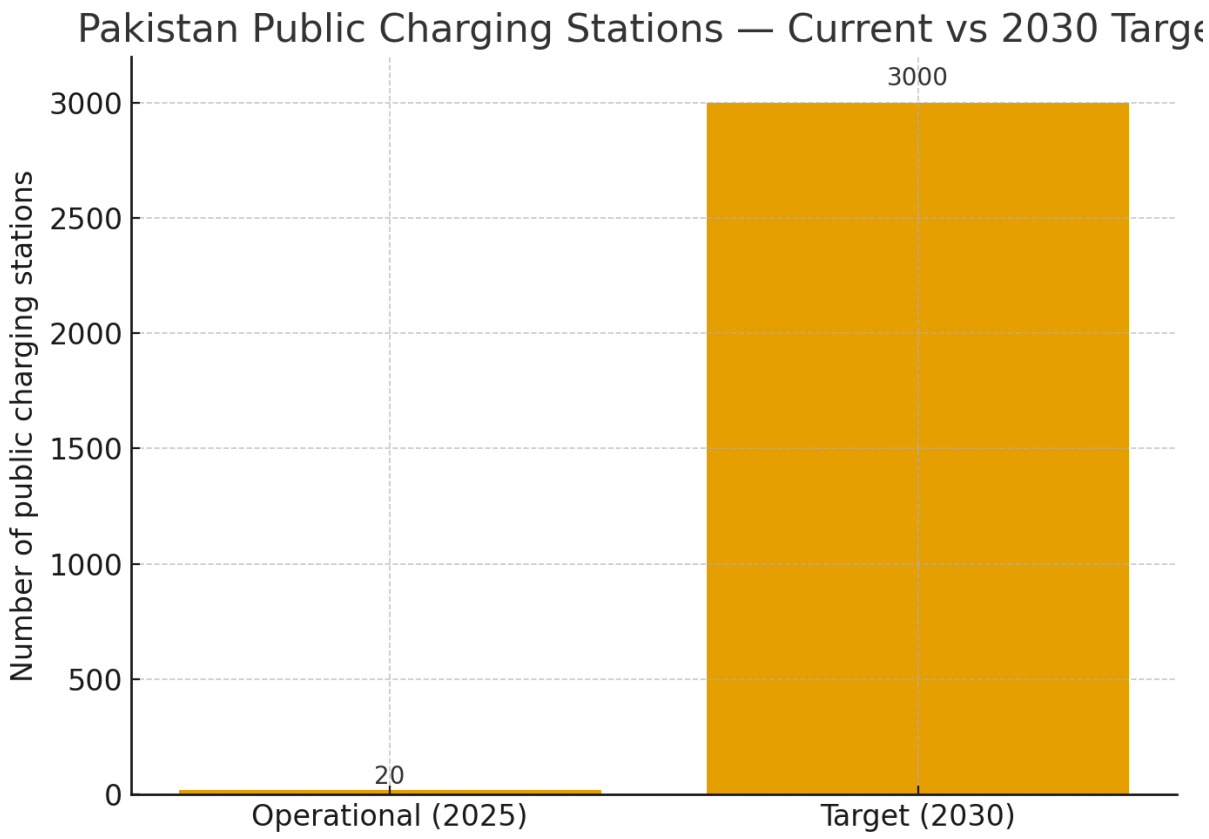
Evidence: The 2019 policy had a significant weakness in the lack of a coordinating authority. One of the academic interviewees specifically suggested the use of a single EV authority to ease the functions of the various levels of government. This is reflected in the draft NEV Policy 2025-30

which recommends the creation of a new EV Steering Committee and Center (NEVC) to monitor implementation.

b) Launch a National Electric Vehicle Charging Infrastructure Plan having definite targets and incentives. Install charging stations on motorways and in big cities via public-private dealings. In 6-12 months, the government agencies like the National Highway Authority (NHA) ought to install fast chargers along the major highways, and license or subsidize private companies to build charging hubs in urban areas. The focus should be on visibility and access; give priority to at least one station along every 100-150 kilometers of highways and piloting stations in each large city. These are to minimize consumer range anxiety.

Evidence: Stakeholders identified the crucial lack of charging infrastructure as a short-term consumer impediment. The NEV Policy draft guiding the NHA to install 40 fast chargers in 6 months and predicting the presence of an approximate of 3,000 stations in 2030. Experts suggest using such roll-out with renewable energy and back-up energy in order to be reliable - which can be taken into account at the very beginning.

Fig 8.1: Pakistan Public Charging stations – Current vs 2030 Target



Reference: Authors own illustration from online sources

a) Increase consumer incentives and green financing programs to electric vehicles, including two- and three-wheelers and public transport. Enhance affordability by increasing financial incentives, such as the subsidy of electric two-wheelers (around 50,000-65,000 per e-bike) and rickshaws (around 0.4 million per three-wheeler). Reduce the importation duties on cheap e-bikes and battery parts. Co-operate with the State Bank of Pakistan to provide cheap green auto loans at low interest rates to the consumer, middle-income group and fleet operators who own urban delivery services, etc., through commercial banks. All these are aimed at lowering the price of the motorcycles, rickshaws, and buses, optimizing the approach towards the early adoption of EVs.

Evidence: Government officials admit that affordability is the key to the EV adoption. EV GST has already been reduced to 1 percent and some subsidies on e-bikes and e-rickshaws have already been introduced in Pakistan, yet their adoption is not widespread yet due to EVs remaining approximately 40 percent more expensive than their petrol counterparts. It has been observed by industry experts that other nations (e.g. the FAME program in India) have successfully combined purchase subsidies with localization incentives to successfully increase early adoption. Our interviewees also encouraged the urgent delivery of concrete incentives (and low-cost financing) in order to turn the latent demand into sales, particularly those of the two-wheelers, which control the vehicle market.

8.2 Medium-term (around 3-5 years):

Introduce structural changes and increase efforts as the market of the electric vehicle evolves.

a) Enact policy continuity to ensure incentives and targets of electric vehicles. Enshrine EV policy in laws or long-term policies by 2025 to avoid the policy retracing or stagnation. As one example, a promotion act on EVs can be enacted to set targets on 2030 and ensure that core incentives, including tax reductions and import duty exemptions, will last a certain term of 5-10 years regardless of any changes in governments. Require the EV Council to review progress bi-annually and revise strategies, where appropriate, without neglecting the overall goals. Such steps will provide a certain environment to invest in EV.

Evidence: Both the governmental and industry stakeholders in our study emphasised that policy inconsistency has killed investor confidence. There is uncertainty about the abrupt change of taxes and ad-hoc automotive policies in Pakistan. The suggestion of policy analysts is to lock EV

incentives in a given time in order to assure businesses and consumers. Scholars commented that the 2019 policy has no binding framework, and the proposal of the draft 2025-30 policy to have a biennial review is a move towards adaptive continuity. Law making the EV roadmap would legalize a commitment of long-term commitment and create a shield against the cyclical nature of stop and start that has been a bane of the sector in the past.

b) Encourage the local production of electric vehicles, including joint ventures and incentives on the production of electric vehicles in Pakistan. Until 2028, use fiscal and industrial policy instruments to build a domestic EV industry. Enter into joint ventures with well-established manufacturers in foreign countries like China and European countries through provision of tax holidays, land in Special Economic Zones and easy approvals. Transfer of mandate and localization in phases. Connect consumer incentives to local assembly by offering more subsidies or lower sales tax on EV collected in Pakistan. By 2025-26, domestic assembly of several two-wheelers and entry-level vehicles should be achieved to create jobs and develop suppliers. Later in the decade, demand local components like batteries and charging devices to support development of the upstream industry.

c) Evidence: As we are able to entangle, the initial policy of EVs in Pakistan did not do much to attract the local automotive industry - the incumbents rested on their laurels, and startups did not receive favors, and the country continued to rely on imports. Policymakers and experts interviewed also think that EVs will not become affordable or strategically marginal without local production. Some other nations have used JVs to increase local EV production (e.g., India with its model of partnership (Tata-JLR, JSW-SAIC)) and Indonesia with its agreements on local battery plants. Researchers at PIDE also encourage Pakistan to take advantage of CPEC to use in joint-ventures,

as well as technology transfer in the production of NEVs. This is available in the draft NEV 2025-30 policy that will provide incentives on domestic manufacturing and value addition. Pakistan expects to reach a high level of localization (i.e. a large proportion of 2-and 3-wheelers to be produced locally) by 2030. Making JVs and localization in the medium term is, therefore, essential to achieving the said targets and making sure that EV adoption simultaneously sets up national industrial capacity.

d) Increase the charge vehicle network and connect it to the national grid. Expand on pilot projects with building of big infrastructure in the years 2025-2030. In medium term, set up hundreds of highways and urban center public charging stations with both public and private funds. Grant or viability gap funding to companies in strategic locations. Increase grid capacity and encourage the use of renewable energy to charge EVs. Provide incentives to solar power stations and work with the utilities to introduce off-peak tariffs. By 2027, show improvement to 3,000 stations and make sure all highways have at least one fast charger in every 50 kilometers by 2030. This upgrading of infrastructure will lead to the further use of EV.

Evidence: According to the draft NEV Policy, the annual rate of deployment of charging facilities is expected to be 240 (2025-26) and 1030 (by 2029-30) indicating the necessity of a rapid scale. Those interviewed in our research revealed that the infrastructure implementation should proceed at the same speed (or preferably ahead) as the vehicle adoption in order to prevent congestion. They further identified the energy limitation in Pakistan, suggesting the installation of renewable-charged chargers and grid enhancement in order to make EV charging reliable and sustainable. Policies like special electricity tariffs on EVs and the provision of future buildings to be EV-ready (which is what the NEVP draft suggests) will be essential to mainstreaming by the end of 2020s.

Concisely, the medium term must also be characterized by an increase in the number of chargers, but also by smarter charging infrastructure that is in sync with the upgrades in the power sector.

e) Invest in research and technical training in electric vehicles and industry-academia cooperation. In five years, have a minimum of one national EV research and development (R&D) and testing center which could be in one of the top engineering school or under the proposed National Electric Vehicle Center (NEVC). At the same time, introduce EV-related skill training, revise university education by adding e-mobility engineering to the curricula, and develop vocational training in the field of EV maintenance and battery control. Develop collaboration between Pakistani universities and foreign excellence centers e.g. Chinese EV research institutes in order to transfer knowledge. The medium-term objective is to establish a local talent pool and an ecosystem of innovation that would be able to sustain the new EV business. An example would be that by 2025- 26, Higher Education Commission (HEC) may finance joint academia-industry research on how to localize battery components or enhance the design of chargers to suit Pakistan. Enhancement of such linkages will facilitate the fact that policy and industry endeavors are supported with the domestic scientific and technical expertise.

Evidence: A significant shortage in the past auto policies of Pakistan was the insignificant attention to the research and development (R&D) and human capital. The discussions with academic experts highlighted in our interviews indicated that Pakistan would not be able to get out of the rut of the imported technology unless it invests in local know-how. They emphasized the possibilities to cooperate with other nations such as China - such as establishing EV research centers that are supported by Chinese technology. The 2025-30 draft policy already states intentions to have an EV center of excellence and a focus on EV issues in training institutes. This strategy is also proven

in the international experience: China successfully entered the EV market due to the high quality of the university-industry network, and even such a country as Thailand has already launched EV talent programs. Such actions would allow developing an innovation base (no matter how small at first) and adapting and refining EV technologies in Pakistan. This will be an addition to the manufacturing incentives as it will offer the skilled workforce, as well as indigenous development to long term sustainability.

8.3 Long-Term (beyond 5 years):

Make it possible to localize the industry fully, integrate with the national grid, and continue increasing the market of electric vehicles.

a) Make domestic battery production and recycling facilities and introduce electric vehicles to the clean energy sources. Pakistan should develop a local battery supply chain, which will first be based on assembly, and facilitation of EV battery recycling or reuse between 2030 and 2035. To achieve this goal, it is necessary to attract investment in battery cell assembly or pack production, where possible use domestic minerals, or enter into regional collaborations. Use of regulations on Extended Producer Responsibility (EPR) to have safe collection and recycling of used batteries. A large percentage of EV batteries are expected to be recyclable in the country by the early 2030s, which will aid in a circular economy. At the same time, ensure that the transition to the electric grid is geared towards EV adoption, meaning increasing the renewable energy sources e.g. solar and wind. EV deployment should be closely associated with renewable energy policy objectives in the long term, with the aim of ensuring a significant proportion of EV charging is run on renewable energy by 2030 and ensuring EV expansion is in line with the national

objective of 60 percent of clean electricity by 2040. This will integrate the maximum environmental benefits of transport electrification.

Evidence: Scholars highlighted that in the absence of cleaner electricity, EVs would simply transfer the tailpipe emissions to the power plant; our own scholarly stakeholders, in particular, pointed out that the coal- and gas-intensive grid in Pakistan is nullifying the EVs. The two-pronged policy solution includes localizing the most value-intensive EV piece (batteries) and charging the energy supplying EVs. The policy brief of PIDE on NEV 2025-2030 suggests a definite guideline on battery recycling to work on the impacts of life cycle. Another concept that our interviews brought with them was to make Pakistan a regional battery recycling/reuse center in the long-term, which would need to be vigorously developed with recycling technologies and regulations at the present. On the energy side, the NEV draft policy admits the necessity of renewable integration (the suggestion of off-peak EV tariffs and incentives of solar charging). Further growth of solar and wind (as envisaged in the revised NDCs of Pakistan) will imply that by 2030-2035, every incremental EV produces much lower emissions than it does currently. In brief, with the help of local production and renewable synergy, that turns batteries and energy greener, Pakistan can make its EV transition long-term economically and environmentally sustainable.

b) Make Pakistan a regional exporter of electric cars and make heavier forms of transport electric. In the next 10-15 years, the policy is supposed to shift to the sole domestic adoption policy to create competence in the regional EV market. This also involves incentivation of EVs and components export by providing targets i.e. by 2030, it is planned to export about 10 percent of the locally made EVs and by 2040, this percentage should be 2x. Sign trade agreements or tariff preferences with Central Asian and Middle Eastern markets on EV products of Pakistani origin.

The export competitiveness will be achieved through the compliance with the quality standards and lowering the expenses, with the medium-term measures of export competitiveness being the localization and research and development. Also, the long-term plan must focus on massive electrification of government and business transportation. A large share of new urban buses and possibly freight trucks ought to be electric by 2030, with specific programs such as government subsidies and climate finance. In the medium term: pilot electric bus corridors, and eventually fully converting the fleet in the major cities by the mid-2030s. By 2040, Pakistan not only must have domestic EV goals, including 90 percent of new cars being electric, but also gain a spot in the international EV supply chain by exporting vehicles, batteries, or software, so that the transition is economically beneficial to the country.

Evidence: The creation of an export-led EV industry has been a staple of successful modifications in the auto-sector in places such as Thailand and China. The planners of Pakistan have begun to acknowledge this: the most recent policy debates have export incentives of EV and parts to persuade companies to produce on a larger scale than the local market. EV outlook at PIDE implies that Pakistan has to make sure that the industry is viable in the long term by reaching regional markets. Similarly, in our interviews with industry analysts, there is hope that, given policy predictability and encouragement over an investment period of say 10 years, Pakistani companies (perhaps new entrants) will be able to start selling e-bikes or parts to the emerging markets. Stakeholders, as far as heavy transport is concerned, emphasized that buses and trucks should not be left behind - they are the major causes of pollution. Only a few government officials have observed electric bus pilots, which continued being piloted, but a massive investment will be necessary to scale it up. Other developing nations (e.g., Chile, India) have led steps in the use of e-bus through concessional financing and city-wide requirements. With this kind of planning in

place, Pakistan would not have to go through a two-layer transition. Even in the long run, such ambitious targets of 90 percent electrification by the year 2040 that were initially proposed by EV policy will only prove to be possible when all the vehicle segments such as buses and freight segments are included in the program.

Chapter 9:

Limitations & Future Research

9.1 Limitations

a) **Qualitative Scope and Generalizability:** This study is based on interviews conducted in Pakistan and identifies barriers specific to this context. Predicting outcomes in other settings requires additional quantitative validation.

b) **Self-Reported Data and Potential Biases:** Stakeholder accounts may be influenced by social desirability or subjective perspectives. Inclusion of government, industry, and academic viewpoints aimed to mitigate this limitation, though some perception biases may persist.

c) **Context Specificity:** The findings are influenced by Pakistan's distinct institutional, cultural, and economic conditions, such as prolonged power outages and local political dynamics. Barriers including fuel shortages or transportation norms may vary in other contexts. Caution is necessary when applying these conclusions to different settings.

d) **Methodological Constraints:** The thematic coding approach employed is systematic but inherently interpretive. Alternative analysts or coding schemes could identify different themes. The absence of quantitative measures, such as market share data or econometric analysis, further limits the study's scope.

e) **No Quantitative Impact Assessment:** The study qualitatively identifies key factors but does not measure their relative influence. For instance, it does not quantify the effect of specific subsidies on adoption rates or determine which barrier most significantly suppresses electric vehicle uptake in numerical terms.

f) **Researcher Reflexivity:** The interpretation of interview data may be influenced by the researcher's background and assumptions. Reflexive practices, including field notes and peer debriefing, were implemented to address this issue, though some analytical bias may persist.

9.2 Future Research Directions

To address the limitations identified in this study, future research should consider the following directions:

a) **Large-Scale Surveys and Modeling:** Future research should implement national surveys targeting consumers in particular, firms, and officials to quantify attitudes, willingness to pay, and perceived barriers to electric vehicle (EV) adoption. Employing statistical models, such as discrete choice models or system dynamics models, would enable assessment of factor impacts and facilitate forecasting of EV uptake under alternative policy scenarios.

b) **Segmentation and Micro-Level Analysis:** Researchers could study EV adoption in specific segments, such as urban versus rural households, different income or gender groups, or vehicle classes. Focusing on two- and three-wheelers, which dominate Pakistan's vehicle fleet, could reveal tailored solutions.

c) **Field Experiments and Pilots:** Pilot programs should be implemented to test specific interventions, such as varying subsidy levels in selected cities or conducting targeted awareness campaigns. Where feasible, randomized controlled trials can be used to measure effects on sales. Behavioral experiments, including the use of nudges or incentives, may identify the most effective strategies for increasing EV adoption.

d) **Comparative Case Studies:** Researchers could compare Pakistan's EV journey with similar developing countries, such as India or Bangladesh. This comparison would help distinguish universal from context-specific factors. Within Pakistan, researchers can compare provinces or cities with different policies, such as Punjab and Khyber Pakhtunkhwa. This could show how local governance, urbanization, or culture shape outcomes.

e) **Policy and Economic Analysis:** Quantitative tools can help evaluate the impacts of policies. Models such as computable general equilibrium (CGE, which simulates an entire economy to assess policy changes) or cost-benefit analysis (which compares costs and anticipated benefits) could estimate the long-term effects of EV adoption. These effects include changes to emissions, foreign exchange, and job creation. Scenario analysis (examining different policy outcomes) can identify the optimal mix of incentives, for example, determining the subsidy needed for the greatest emissions reduction per rupee spent.

f) **Technical and Infrastructure Research:** Future studies should analyze strategies for integrating electric vehicles (EVs) into existing transportation and energy systems. This includes optimizing the placement of EV charging stations, modeling the impact of smart charging on the power grid, and evaluating methods for reusing or recycling EV batteries. Research on integrating EV charging with solar power systems may provide additional benefits for Pakistan.

g) **Social and Cultural Studies:** In-depth qualitative studies, such as ethnographies or focus groups, could examine the social side of EV adoption. For example, studying how family

dynamics, social networks, or media influence vehicle choice may reveal hidden barriers not captured by policy analysis alone.

Pursuing these research directions will strengthen the evidence base and support the development of more effective, data-driven policies for sustainable transportation in Pakistan.

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