EXPLORING THE CARBON CREDIT MARKET: OPPORTUNITIES AND CHALLENGES FOR PAKISTAN

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I, **Abid Nawaz**, hereby state that my MPhil thesis titled "**Exploring the Carbon Credit Market Opportunities and Challenges for Pakistan"** is my own work and has not been submitted previously by me for any degree from Pakistan Institute of Development Economics or anywhere else in the country/world.

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Lastly, I commit this thesis to all who are striving to make a sustainable and climate-adaptive Pakistan. Hopefully, this work can help in the right direction towards the effective policies and practices of a greener future.

ABSTRACT

This thesis analyses potential opportunities and challenges in the creation of a carbon market in Pakistan with a focus on the industrial and transport sectors. The research based on the qualitative case study design is conducted on the basis of the semi-structured interviews with policymakers, experts, representatives of industry, and transport and including the review of relevant policy documents and international best practices. The paper evaluates the policy, institutional, and financial preparedness of Pakistan to engage in the market context, especially in the face of the Carbon Market Policy Guidelines (2024).

Results indicate that there is a weak level of awareness and knowledge concerning carbon credit trading amongst the major stakeholders, minimal technical potential, and preparedness in the sectors. The industrial sector demonstrates some willingness, but the transport one, in spite of the attempts towards the electric car, displays no effective emission reduction plans or programs that can be credited. Financial restrictions, the existence of unreliable Monitoring, Reporting, and Verification (MRV) strategies, and a lack of legal establishments are the major obstacles.

Based on the international experience, the study lists the actions that will be vital factors to success: the clear legal framework development, design of sector-specific MRV methodologies, the improvement of capacity building, and presentation of specific incentives, including tax relief and green finance. The PPPs become a very important dynamo for investment mobilization and stakeholder active engagements.

This thesis finds that Pakistan has immense mitigation potential, but that it seeks to carry out an effective carbon credit market by filling institutional gaps, aligning national policies to international specifications, and also by leveraging cross-sector cooperation to pique both local and foreign investment.

Keywords: Carbon Credit Market, Industrial Sector, Transport Sector, Pakistan, MRV systems, Voluntary Market, Compliance Market, Climate Policy, Sustainable Development.

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CCM	Carbon Credit Market
CDM	Clean Development Mechanism
CNG	Compressed Natural Gas
COP	Conference of the Parties
COP29	29th Conference of the Parties
ETS	Emissions Trading System
EV	Electric Vehicle
GHG	Greenhouse Gas
ICAP	International Carbon Action Partnership
IPCC	Intergovernmental Panel on Climate Change
MoCC&EC	Ministry of Climate Change & Environmental Coordination
MRV	Monitoring, Reporting, and Verification
NDC	Nationally Determined Contribution
NESPAK	National Engineering Services Pakistan
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
PPP	Public–Public-Private Partnership
RMI	Rocky Mountain Institute
SDGs	Sustainable Development Goals
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
VCM	Voluntary Carbon Market
WB	World Bank
WRI	World Resources Institute
WWF	World Wide Fund for Nature

CHAPTER 1

INTRODUCTION

The climate change problem is one of the most important and urgent issues in the contemporary global world. These waves of warmer weather, including floods, droughts, wildfires, heatwaves, and so on, are manifestations of the vast and immense implications of a warming world (WMO, 2025).The Intergovernmental Panel on Climate Change has also underscored the fact that access to global temperature thresholds of 1.5 degrees Celsius above pre-industrial levels is needed. When this limit is passed, the consequences would be disastrous and irreparable to the ecosystems, economies, and communities of the planet (IPCC, 2018). There is thus an urgent need to take collective measures to reduce the impact of greenhouse gases (GHG) and change towards a much more sustainable path. which is possible in the context of carbon trading.

Carbon trading, among other market-related mechanisms, has been in the spotlight as one of the mechanisms that can be used in addressing climate change (World Bank, 2023). The cap-and-trade systems and the voluntary offset approaches that are part of the Carbon Credit Market (CCM) will be one of the essential ways through which countries can achieve their emission-reduction obligations (Hepburn et al., 2020). The EU ETS, which is the first and largest carbon market globally, is the most noticeable indicator that carbon pricing can trigger emission reduction motivations, technological developments in clean energies, and promote sustainable development (European Commission, 2023). These systems are increasingly being implemented in various regions, with even the developing economies taking them up as a means to open up funding of climate action without losing economic competitive advantage (World Bank, 2025b).

Figure 1: **Basic Structure of a Carbon Credit Mechanism**

Source: (*Emissions Trading Worldwide*, 2025)

This is because carbon credits are simply like permits, which a person can use so that they can emit a particular amount of carbon dioxide or other greenhouse gases (ClimateSeed, 2025). A single carbon credit usually signifies 1 metric ton of CO2 equivalent (tCO2e) kept out of or gotten back out of the air (UNDP, 2022b). Such credits can be created by different projects like renewable energy, energy efficiency, reforestation, and the capture of methane (CarbonCredits.com, 2025). A company that exceeds its emission limit can buy a carbon credit that can be used to cover the additional emissions beyond its limits, and companies that are below their limits can sell their excess credits in the market. This will give developing countries, and individuals an economic motivation to invest in low-carbon technologies and practices (World Bank Group, 2025).

Carbon markets have a positive effect to the developing countries and this serves as an incentive to them. The fact that the Carbon markets are a win-win situation to the developing nations. On one hand, they are also a means of allaying climate change as they will be beneficiary in the adaption that is on a financial scale. On the other hand, they give a chance to foreign investment and promote the objectives of sustainable development. Nevertheless, the development and operations of these markets often become depressed when violence or several impediments such as institutional inefficiencies, regulatory uncertainties, lack of technical capacity, and limited access to climate finance are present. This implies that effective implementation of the carbon credit schemes in developed and developing both countries requires the presence of sound governance mechanisms, project monitoring and checking, as well as the incorporation of key players.

Although as a developing country Pakistan contributes in a very minimal way to global GHG emissions, it is one of the most vulnerable countries to the effects of climate change. Recent years have been characterized by a number of severe weather phenomena, the 2022 floods being the worst in the history of the country and affecting millions of people, causing tremendous economic and infrastructure losses (Uraan Pakistan, 2024). Pakistan, being a developing country with a large population and with the population further increasing, has the challenge of maintaining economic development and minimizing it on nature. The urgency of moving to a low-carbon economy has never been higher. As in Pakistan industry and transport sectors are high emitters of GHG's.

The industrial and transport sectors in Pakistan are the ones producing the greatest number of emissions in the country. The industry contribution to GHG emissions is about 32 percent, and the transport sector is about 28 percent of the CO2 emissions (Climate Transparency, 2020). These sectors are known to be the determinant in the economic development of the country and they are also the major hotspots of emission. Therefore, any valuable mitigation strategy must consider the emissions generated by these two industries. The opportunity to drive emission reductions by integrating the carbon credit mechanisms in the following areas provides a feasible way to attain the goals of energy efficiency and green infrastructure.

Table 1: **Sector-Wise CO_2 Emissions in Pakistan (2023)**

Sector	Emissions Share (%)	Key Sources
Industry	32%	Cement, steel, textiles
Transport	28%	Diesel vehicles, aviation
Energy	27%	Power plants, oil & gas sector
Agriculture	8%	Livestock, rice paddies
Waste	5%	Landfills, wastewater

Source: (Climate Transparency, 2020)

This table shows a clear picture of which sectors contribute the most to national emissions, underlining the need to target industry and transport in Pakistan's CCM strategy.

Reflecting the incremental significance of the carbon markets, Pakistan has become more interested in the integration of the carbon credit systems into the climate policy framework in the country (MCCECP, 2024). Pakistan Carbon Market Policy Guidelines (2024) will be a significant step towards it. These principles are designed to have an orderly and rule-based carbon trading scheme that will suit international practice and will enable the involvement of the state and the private owned. Monitoring, Reporting, and Verification (MRV) of systems, stakeholder involvement, and regulatory support have been highlighted in the guidelines, which help in establishing the credibility and effectiveness of carbon credit programs. As an international observer, we can observe the efficiency of the carbon credit programs and the necessity of the market to the developing countries and the increasing significance of the market.

Also, the global climate discussions, especially the Conference of the Parties (COP) under the United Nations Framework Convention on Climate Change (UNFCCC), have boosted the use of carbon markets with a view to meeting the objectives under the Paris Agreement. At COP29, increased attention was given to strengthening the inclusion of developing countries in carbon markets and the provision of climate finance to assist developing countries in mitigation and adaptation projects. To pursue the investment, enhance the technological capability, and help in achieving global climate targets, alignment of national policies with such international commitments is needed in Pakistan (UNFCCC, 2024). But for Pakistan there are some barriers as well.

However, despite all these developments, there are challenges that are hindering the existence of carbon credit markets in Pakistan. Lack of a national carbon registry, little awareness on the side of key stakeholders, poor MRV infrastructure, and poor institutional coordination are some of the key barriers that should be overcome. In addition, the data transparency and the validation of the projects, as well as the issuance of the credit, remain an obvious problem. To address such obstacles, governmental agencies, the business sector, civil organizations, and international partners must make collective efforts (Zahra, 2025). As the country needs to tackle down such crucial challenging dimensions of the market.

Institutional readiness is one of the most important dimensions that needs to be explored in the case of Pakistan. An efficient carbon market demands proper legal and regulatory systems and institutions that can carry out the processes of market regulation, monitoring of emissions, and the

enforcement of compliance. Currently, the institutional framework in Pakistan lacks coherence and clarity on its mandate and thus lacks coordination between national and provincial agencies. To have a harmonious policy, a centralized authority regarding the carbon market is crucial to facilitate better interagency cooperation (UNEP-CCC, 2024). For which an active human capital, authentic information and better infrastructure is needed for market capacity.

Capacity building is another issue. Human capital is also required to support a policy and infrastructure that enables a carbon credit market to be operated successfully. The stakeholders in the public and private sectors are also not aware of the dynamics of carbon markets, the requirements of registration of the projects, and the processes of certification. This knowledge gap can be filled by comprehensive training programs and campaigns to create full awareness among the industry leaders and transport operators, as well as the policy makers, which would create an enabling environment for getting into the market (Karandaaz Pakistan, 2025). Although there is a proper market financial mechanism.

The financial aspect is crucial for the carbon market that must be considered. Carbon markets flourish when the environment is such that the developers of the projects are able to tap into seed capital and credit lines, and risk aversion mechanisms. Even in Pakistan, where risks are high on the investment and green financing is still not readily available, it becomes unattractive to lead any carbon offset project by the private sector. These barriers can be overcome by establishing green finance windows in the development banks, available on concessional loans, and enabling partnerships with international climate finance funds, and off course observing international experience of carbon credit programs.

Apart from the United States, there is a lesson to learn in countries like China, South Korea, and India internationally. China has created the biggest carbon market in the world, dealing with the power sector, and has well-developed MRVs and transparent emissions limits. South Korea has adopted market-based tools that have a high degree of integration of the private sector. Energy efficiency regulations coupled with tradable permits are lumped together in India: PAT (Perform, Achieve, and Trade). Pakistan is in a position to learn from this experience to establish flexible yet sustainable mechanisms that would be specific to its institutions and developmental context (Hashmi, 2024).

Table 2: **Comparison of Carbon Market Maturity**

Country	Market Type	Coverage Sectors	Key Strengths
EU (ETS)	Compliance	Power, industry, aviation	Cap-and-trade maturity, MRV enforcement
China	Compliance	Power sector	Scale, data tracking innovations
India (PAT)	Tradable Permits	Industry	Energy efficiency incentivization
Pakistan	Emerging/Voluntary	Industry, transport (planned)	Policy guidelines in development

S*ource*: (Hemmingsen, 2025a)

This comparison highlights Pakistan's early-stage carbon market status in contrast to more developed systems, offering lessons in institutional strengthening and MRV deployment.

Observing international experience will lead the country to generate market potential of the sectors, as different sectors have specific challenges and its potential, just like with a closer look at the transport and industrial sectors, we may identify the scale and the scope of the opportunity to reduce emissions. Urban traffic congestion, poor fuel economy, and old vehicle fleets are other major sources of emissions in the transport sector. Green transport, such as the promotion of public transport and the encouragement of the use of electric vehicles, and the investment in non-motorized transport infrastructure, will help decrease the carbon footprint of this industry. The industrial sector is characterized by energy-intensive processes, obsolete equipment, and the use

of fossil fuels that prevent the mitigation of emissions (Climate Transparency, 2020). Policies that encourage cleaner production methods, recovery of waste heat, and incorporation of renewable energy will be essential. For which peoples, government and institutional coordination is must.

Consultation with the stakeholders is a critical element in any development of a carbon market. Consulting with the local communities, industry associations, academia, and civil society organizations creates a sense of transparency and buy-in. More responsive and equitable carbon market policies can be achieved with structured consultation mechanisms, public hearings, and inclusive policy dialogues (Nature Finance, 2022).

In addition, online platforms and data-gathering applications can support collaboration among stakeholders and monitor the success of the projects.

Lastly, the development of the carbon market can be combined with the achievement of overall sustainable development goals (SDGs) and leading to the duplication of the gains. Carbon-generating projects may also result in job creation, production of energy, gender equality, and species diversity. Building synergies between climate action and socio-economic development will enhance the viability and sustainable carbon credit market in Pakistan.

Pakistan must develop a flexible and yet credible carbon market based on the global best practices, which it must adjust to its institutional and developmental environment. China can teach Pakistan to establish transparent monitoring, reporting, and verification systems, and a clear limit to emissions, to become credible. The major lesson of South Korea is to integrate the private sector with market-based instruments that can be used to attract investments and increase participation. Pakistan can follow this tactic of India, which entails attaching regulations on energy efficiency with trade permits and establishing balancing mechanisms between regulation and flexibility. Meanwhile, Pakistan is to deal with its sector-level problems in the field of transport and industry by advancing the use of public transport, electric vehicles, cleaner technologies, renewable energy, and better infrastructure. Combined, the lessons are a way that Pakistan can develop a sustainable, engaging, and efficient carbon market structure (Zahra, 2025).

Conclusively, the exploration of the carbon credit market in the case of Pakistan is a difficult but hopeful venture. It has made significant policy measures and is ready to concentrate on operational preparedness, establishment capacity, funding mechanisms, and engagement of stakeholders. With

both the experience of the world and the investments in the solutions already being made locally, Pakistan will be able to create a credible and effective carbon market that shapes its climate and development ambitions.

1.1 Research Problem

Although the introduction of such policy instruments as the Pakistan Carbon Market Policy Guidelines (2024) has created some opportunities for the implementation and usefulness of the mechanism of carbon credits in Pakistan, some challenges loom, which complicate the processes. An outstanding research issue is the discrepancy between policy-making and operational implementation, especially in those areas that are significant producers of national emissions, such as industry and transport. Although these industries are critical in the process of economic development, the efficiency of technology, lack of awareness of available carbon market tools, and poor policy implementation erode any meaningful contribution to the carbon trading initiatives.

What is more, there is no developed institutional architecture of monitoring, reporting, and verification (MRV) in Pakistan that would allow the country to develop integration into international carbon markets and establish credibility in such markets. There is also a lack of interaction with the private stakeholders, and there is not enough incentive to mobilize investments in the carbon-reduction projects. Moreover, the fact that the global carbon credit market is growing to be competitive and rather technical is likely to render the developing countries like Pakistan even more marginalized unless they take active steps to build capacity.

Added to these problems is the lack of literature that critically examines the preparedness of policy, institutional, and financial sectors of Pakistan to instantiate a carbon market, especially in the industrial and transport sectors. This gap is the reason why it is important to have context-specific research, which would be useful to formulate policy and practice.

The given research proposal, thus, would not examine the potential usefulness of carbon credit markets in Pakistan only in the theoretical sense but also focus on the practical, institutional, and policy-based factors that hinder their active adoption. It is important to note such problems in the context of the occurrence of designing a more inclusive and operational carbon credit market that will follow both international best practices and local developmental priorities.

The paper is qualitative research that aims to investigate the aspects of opportunities or challenges in the implementation of the carbon credit market in Pakistan through the industrial and transport sectors. The research will examine the policy landscape, experience of stakeholders, and multilateral best practices through semi-structured interviews, analysis of documents, and thematic analysis. The intention is to point out actionable information that can be used to access policy, carry out investment in carbon reduction schemes, and enrich Pakistan in both voluntary and compliance carbon markets.

In this way, the research could play a role in the emergent public debate on the topic of climate financing, green industrial transformation, and sustainable mobility in emerging economies. It highlights the necessity of an inclusive and flexible framework of the carbon market, adapted to accommodate the priorities of development in Pakistan and the direction of environmental targets. Finally, the study aims to help Pakistan become more low-carbon and increase its adaptability to climate change.

Although the world has increasingly focused on the concept of carbon market mechanisms and Pakistan has already adopted the Carbon Market Policy Guidelines (2024), the gap in the literature concerning the true preparedness of the country to implement the concept of the carbon market remains quite significant. The current literature has mostly concentrated on the policy making or climate statistics but has not critically looked at the institutional, policy and financial readiness to make it work. Specifically, there is little in the literature regarding the ability of the industrial and transport industry, which is the two biggest contributors to emissions, to be incorporated into carbon credit schemes. This research thus bridges this gap by investigating sectoral and institutional strengths, awareness of stakeholders and alignment of policies to international standards of carbon markets in Pakistan.

1.2 Statement of the Problem

Going by the account of the research Problem as presented in the foregoing text, I am refining my research problem thus: “The industrial and transport sectors in Pakistan have difficulties in venturing into carbon credit markets due to ineffective policy implementation, the lack of

institutional capacities and low awareness among the stakeholders." and operationalized the following research questions and objectives as my topic.

It is a literature-supported issue. Ahmed (2023) demonstrates that the transport and industrial sectors of Pakistan, although being one of the largest sources of GHGs, have significant obstacles related to the ineffective implementation of policies and a lack of operational plans to implement the carbon market. Rasool, Zaidi, and Zafar (2019) also conclude that inefficiency of regulation and institutional inefficiency limit mitigation in the transport sector. On the same note, Raza and Lin (2020) prove that decoupling of emissions and growth can occur, though the absence of efficient monitoring and reporting mechanisms still hampers progress. Butt and Singh (2023) also highlight that the awareness and acceptance of alternative carbon-reduction strategies, e.g., electric vehicles, are low, which inhibits the adoption of market-based instruments as well. Moreover, the World Bank (2023) and Climate Transparency (2025) highlight the fact that the climate governance and MRV frameworks in Pakistan are not developed as much as they are globally, which may leave this country on the sidelines of an increasingly global carbon credit market. Thus, the formulated problems of ineffective policy implementation, gaps in institutional capacity, and unawareness of stakeholders are well-reported and constitute the premises of this study.

1.3 Objectives

Keeping in view the past experiences and policies to combat the problem of the carbon credit Trading mechanism and its implementation, the following objectives have been developed to analyze the gap.

1. To identify the potential and challenges of Pakistan CCM, especially in the industrial and transportation sectors.
2. To determine the effectiveness of the CCG 2024 of Pakistan to facilitate investment and reduce emissions.
3. To provide policy recommendations based on the stakeholders' analysis as well as the global best practices.

1.4 Research Questions

1. What is the structure and implementation of the CCM in Pakistan's transportation and industrial sectors?
2 What technical, institutional, and regulatory obstacles prevent Pakistan from developing a strong CCM?

1.5 Significance of the study

This research can be of much importance in various ways, as it links Pakistan's domestic policy with the Global framework. It will also be able to enhance the potential of the policies of carbon trading and environmental conservation by analyzing how the carbon credit system will stimulate the local effort and cut down the emissions by influencing the economy financially, study the carbon credit-based initiatives of industrial and transport sectors in Pakistan, and have some explanations of how much the policies have contributed to their desired outcomes and successes. It will contribute to the efficiency of the policies and the departments in the sense of analyzing whether the right and efficient methods and resources are being employed in accomplishing the results. The ultimate goal of the study is to give recommendations to the country's policy in the international carbon market.

Based on the story of the above text, I am refining the meaning of the research as follows, “the study tries to measure the level of awareness on the practical implementation of CCG 2024 in the high-emission industries and transport in Pakistan sector and how it can be aligned with the global norms to improve the policy effectiveness and access to climate finance more in easily”.

1.6 Unit of Data Collections

In this qualitative research, the following two sources of data were used:

1. Semi-structured interviews to access Key Informants

The stakeholders who had a direct or indirect interest in the carbon market policy, implementation, and compliance were interviewed using semi-structured interviews. These

interviews offered first-hand insights into institutional capacity, sectoral preparedness, policy concerns as well as awareness levels. The key informants included:

- Government Officials: To know the policy construction, the regulatory matters, and the commitments of the nation.
- Industry and Transport Sector Representatives: To evaluate the sector-specific issues, capacities, and availability of willingness to engage in CCM.
- Academics and Experts: There is a need to obtain the analytical opinion on the effectiveness of policies and international consistency.
- NGOs/Civil Society: To investigate involvement with the stakeholders, advocacy, and accountability.
- Private Sector Actors: To analyze interest in the market, market barriers to entry, and investment insight.

2. Document Analysis (policy and institutional reports)

Such sources as documents were also evaluated to explore the legal, institutional, and strategic context in connection with the working out of a carbon market in Pakistan. The key documents included:

- Pakistan Carbon Market Policy Guidelines (2024): To know the objectives and mechanisms at the national level.
- National Climate Policies and MRV Frameworks: To measure governance, systems of compliance, as well as institutional functions.
- International Reports (e.g., UNFCCC, World Bank): To be able to compare the approach done in Pakistan with the best practices and international standards.

All these data sources provided further insight into the opportunities and challenges of the carbon credit market in the industrial and transport sectors in Pakistan and helped to evaluate the implementation of the policy, institutional capacity, and awareness of the stakeholders.

1.7 Scheme of the Study

This thesis is written in seven chapters, which are connected on the basis of each other to help a reader lead him or her through the background of the study to the ultimate conclusions.

Chapter one prepares the groundwork. It provides the background, the problem of the research, and the rationale of the objectives and questions that underpin the study. It also explains the importance of studying the preparedness of Pakistan to carbon credit market.

The second chapter provides the big picture. It follows the history of the carbon credit markets around the world and how they operate and why they are important to the developing nations. It is then reduced to Pakistan and a critical evaluation of its policy framework and institutional environment, also taking in to account the international experiences.

Which also shift the narrative to the academic books. In this case, the controversies, theories, and research of carbon markets are discussed. The deficiencies in the research are identified, particularly in terms of industrial and transport sector in Pakistan, and a conceptual framework of this thesis is created.

The third chapter details the way the research was conducted. It provides the details of study design, sampling and data collection techniques (interviews and document analysis), and analysis. It also establishes the location of the research and the ethical concerns that guided the research.

The results are given in the fourth chapter. It uses primary data and experience of international policies to understand the readiness of the country Pakistan to join the carbon markets. The analysis is structured based on seven themes including: policy and regulatory frameworks, institutional capacity and coordination, MRV systems, financial mechanisms, stakeholder awareness, public-private partnerships, implementation challenges. It also makes a comparison of the preparedness of the industry and transport sectors.

The fifth chapter shifts between the discoveries and meaning. It outlines the implications of the results on the broader literature and global practice, outlines opportunities and challenges and generalizes the level of preparedness as a whole. It further gives out policy and practice implications and ends with a brief conclusion that leads to the last chapter.

At last, the sixth chapter is the conclusion. It overviews the main conclusions, highlights the contribution of the study and ponders over the limitations of the research. It also identifies future research areas and concludes with a reflection of the future point of opportunities and limitations that Pakistan needs to conduct its own research in order to set itself within the international commitment liabilities of carbon markets.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction and Background

The international climate change policy has increasingly diverged towards a more market-driven policy-making beyond regulatory methods, which connect environmental objectives to an economic rationale. The carbon credit market is one of the most notable developments in this respect, as it allows nations and companies to cut down greenhouse gas (GHG) emissions in a cost-efficient way and, additionally, draw in investment and encourage cleaner technologies.

As The carbon credit market offers an excellent opportunity to Pakistan, especially in its industrial and transport sectors, to counter the intensifying greenhouse gas (GHG) emissions and pathways to settle down in sustainable development. Carbon markets have become one of the most visible market-based instruments to reduce the changing climate change in the world by using economic incentives to promote a decrease in emissions and to support the advancement of technology. There has been an increasing interest in academia on how developing countries, including Pakistan, may strategically approach these mechanisms to not only stem their growing emissions but also to release socio-economic gains in line with national development-related priorities (Abrahao et al., 2023; Sun et al., 2025; Yang & Zeng, 2025).

The concept of the carbon market is quite simple: a price is placed on the emissions, which leads to the establishment of an economic motivation aimed at the minimization of greenhouse gases. The carbon credits that the entities produce can be taken as excess of the limit that has been set on them, thus they are allowed to emit less than the limit set on them. Such credits can be sold to other parties who cannot achieve their reduction goals and this enables them to compensate on any extra emission as well as rewarding efficiency and innovation. The process does not just restrict the level of emission, but it also offers a motivation to innovate, be energy efficient and invest sustainably (World Bank, 2023).

In the case of Pakistan, the importance of carbon credit markets cannot be exaggerated. Industry (32%) and transport (28%) were found to be the biggest contributors to national emissions (Climate Transparency, 2020).

The situation of Pakistan in the area of climate change has its challenges and opportunities. Being one of the most climate-prone countries, it has already suffered the dramatic consequences of floods, heatwaves, and droughts leading to significant economic and social losses. Simultaneously, Pakistan can become a part of global carbon markets, and this opportunity may give the country access to global climate finance, a chance to modernize its industry, and to be less reliant on fossil fuels.

This chapter has followed the origin and development of carbon markets, how they work and what their types are, assessed the policies and institutional preparedness of Pakistan and cited some of the international experience. It preconditions the next literature review that is going to critically examine academic debates and outline the gap in the research.

2.2 Origins of Carbon Credit Markets

Carbon credit markets can be said to have been established on the back of the Kyoto Protocol of 1997 which is the first treaty whereby flexible mechanisms through which countries could meet their obligations towards reducing their emissions were introduced through an international agreement. These were the Clean Development Mechanism (CDM), the Joint Implementation (JI) and the International Emissions Trading (IET). In fact, the CDM, especially, turned out to be a ground-breaking move, allowing the developed world to invest in emission reduction activities in the developing world and, in its turn, to obtain certified emission reduction credits. The process allowed third world countries to acquire international finance and clean technologies, at the same time, the developed countries got their commitments met at a cheaper cost. (UNFCCC, 2010).

The Kyoto Protocol provided the foundation to the concept that the emissions could be marketed and exchanged on the international level. Nevertheless, this was narrowed by its tight separation between developed and developing nations. The Paris Agreement of 2015 was a significant development since it created a more inclusive framework (Article 6) so that all signatories, irrespective of their development status, can cooperate via carbon trading. The Paris Agreement,

on the contrary, does not separate the non-Annex I and the Annex I countries as Kyoto does and, therefore, is more flexible and has an extensive participation scope. (UNFCCC, 2023a).

Ever since, the market of carbon has grown fast all over the world. In 2005, the introduction of the European Union Emissions Trading System (EU ETS) was the first massive effort to put a cap-and-trade system into practice. Its performance encouraged other regions to establish comparable projects such as California (2013), South Korea (2015) and China (2021). All these measures are indicative of the development of carbon trading as an exclusive club of global initiatives into a general process of global climate regulation (ICAP, 2023).

Currently, over twenty-eight initiatives of carbon pricing are in operation across the globe, covering approximately 17 percent of the global GHG emissions. This relocation is indicative of the increased understanding that carbon markets both lessen emissions and offer an avenue of economic transformation, innovation and global collaboration (World Bank, 2023).

2.3 Evolution of Carbon Credit Markets

Since its creation in the Kyoto Protocol the carbon credit market has experienced massive evolution since starting as a group of pilot mechanisms, into a strong and growing international system. The Clean Development Mechanism (CDM) ruled the first years and it enabled thousands of projects in renewable energy, forestation and energy efficiency in developing countries. These projects not only minimized the emissions but also gave rise to huge financial streams which formed the basis of carbon trading as a valid climate policy instrument. (UNFCCC, 2023b)

The second key move was the European Union Emissions Trading System (EU ETS) in 2005 which is the largest and most advanced compliance market in the world. Its gradual process, whereby various caps and sectoral growth are tightened as time progresses, proved the possibility of carbon pricing to reduce emissions and keep the economy competitive. Other regions followed closely in the footsteps of this success. California started the cap-and-trade program in 2013, South Korea started the national emissions trading system in 2015, and China started running the largest market in the world in 2021, which initially covers the power industry but has the intention to expand (ICAP, 2023).

The Paris Agreement of 2015 marked the new stage in the development of carbon markets. Article 6 created a legal framework that international cooperation based on the exchange of mitigation outcomes and countries can implement a portion of their nationally determined contributions (NDCs) through market mechanisms. The Paris framework is more flexible and inclusive in that it focuses on universality and voluntary participation unlike the Kyoto Protocol. (UNFCCC, 2023a).

Table 3: **Key Milestones in Carbon Market Development**

Year	Milestone	Description
1997	Kyoto Protocol (CDM, JI, IET)	Introduced international mechanisms for carbon trading under the UNFCCC.
2005	EU ETS Launched	The European Union Emissions Trading System became the world's largest carbon market covering power and industry.
2010	Expansion in Asia, North America, Oceania	Regional carbon markets began emerging in places like China, California, and Australia.
2015	Paris Agreement (Article 6)	Established a global framework for voluntary cooperation through carbon markets.
2020	Voluntary Markets Rise + Article 6 Rules	Surge in corporate climate commitments and clearer rules for international trading.

Source*:* (ICAP, 2023; UNFCCC, 2023b; World Bank, 2023)**.**

The development of carbon markets presented in the form of a timeline according to which the history of Kyoto and Paris development can be followed.

The other aspect of this development is the financial expansion of carbon markets around the world. The compliance and voluntary market have experienced unprecedented growth in trading volume and financial value during the last 10 years. In 2022, the voluntary carbon market was worth more than two billion US dollars, and it is mostly pushed by corporate net-zero commitments (Donofrio & Procton, 2023).

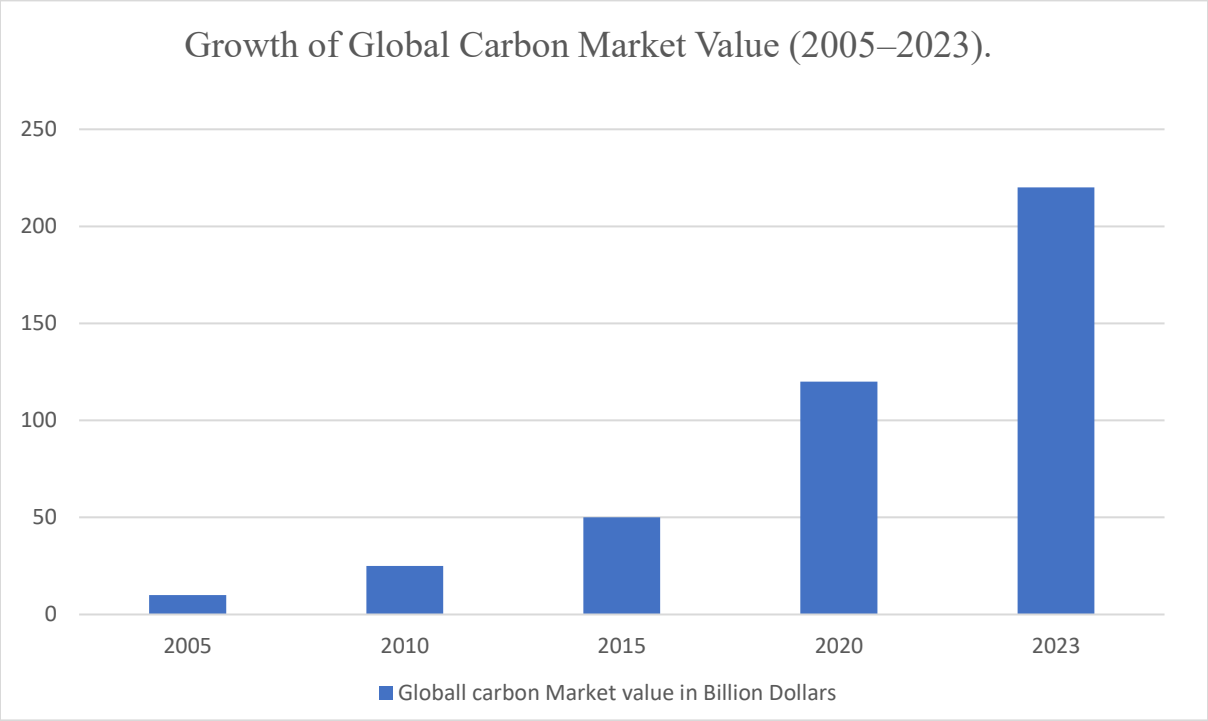

Figure 2: **Growth of Global Carbon Market Value (2005–2023)**

This is a combination of compliance and voluntary markets; X-axis is Years, Y-axis is Market Value in Billion Dollars.
Source*: (Donofrio & Procton, 2023; World Bank, 2023).*

To the course of these developments, carbon markets are no longer experimental. They have been made to form a central part of climate governance in the world and are both flexible and ambitious with a balance between environmental accountability and economic expediency.

According to the literature Carbon credit markets have been developed based on the mechanisms established under the Kyoto Protocol (1997), whereby the Clean Development Mechanism (CDM) and Joint Implementation (JI) were flexible mechanisms that enabled developed nations to fulfill their emission reduction targets by carrying out projects in developing nations. The framework has changed to a more generalized system with the Paris Agreement (2015), which Article 6 offered new forms of cooperation and market solutions in order to attain Nationally Determined Contributions (NDCs). This development represents a shift in more general market-based instruments, and credits around projects emerge both in the voluntary market and the compliance market. It is imperative to gain insights into this evolution to be able to contextualize the role Pakistan plays in the global carbon market environment (UNFCCC, 2023a, 2023b).

2.4 Types and Mechanisms of Carbon Credit Markets

The principles that govern the carbon credit markets are aimed at achieving a balance combining the objectives of the environment and profitability. This is divided into the two broad types, which are compliance markets and voluntary markets, and they depend on the efficient systems of monitoring and verification to provide credibility.

Governments or international agreements create compliance markets which are compulsory to some sectors or even companies. The most famous example is the European Union Emissions Trading System (EU ETS) which is a cap-and-trade system. In this strategy, authorities establish a total emission level of a particular area of pollution, assign or sell quotas to companies, and allow them to trade. Companies that emit lower than their limit are able to sell in excess allowances and those who emit more than what they have to do so have to purchase more credits. The mechanism assures that the cost that will be incurred to curb the emissions is minimal yet the national or regional targets can be achieved (ICAP, 2023).

On the contrary, voluntary carbon markets exist due to corporations, organizations, even individuals who want to buy credits to cover their emissions that are out of the scope of regulation. These markets have expanded at an accelerated rate within the recent years, especially because of corporate pledges of net-zero goals. Other projects usually involve reforestation, renewable energy and community-based energy efficiency projects. Although voluntary markets do not enforce compliance using the legal enforcement of the compliance markets, they are crucial towards funneling finance to climate mitigation activities in the developing nations (Donofrio & Procton, 2023)

Third is the system of baseline and credit that requires projects or entities to gain credits through lowering emissions compared to a set baseline situation. An illustration of this is the case of a cement factory that uses technology that is more efficient, and it can take credits on the difference between the real and baseline emissions. It is then possible to sell these credits either in compliance or voluntary markets.

The key to all these processes is the principle of Monitoring, Reporting, and Verification (MRV). Carbon credits will not be assured without stringent MRV systems. Experiential countries such as South Korea and China have made massive investments on MRV to retain credibility, and most developing countries, such as Pakistan, have difficulties in this aspect (World Bank, 2023).

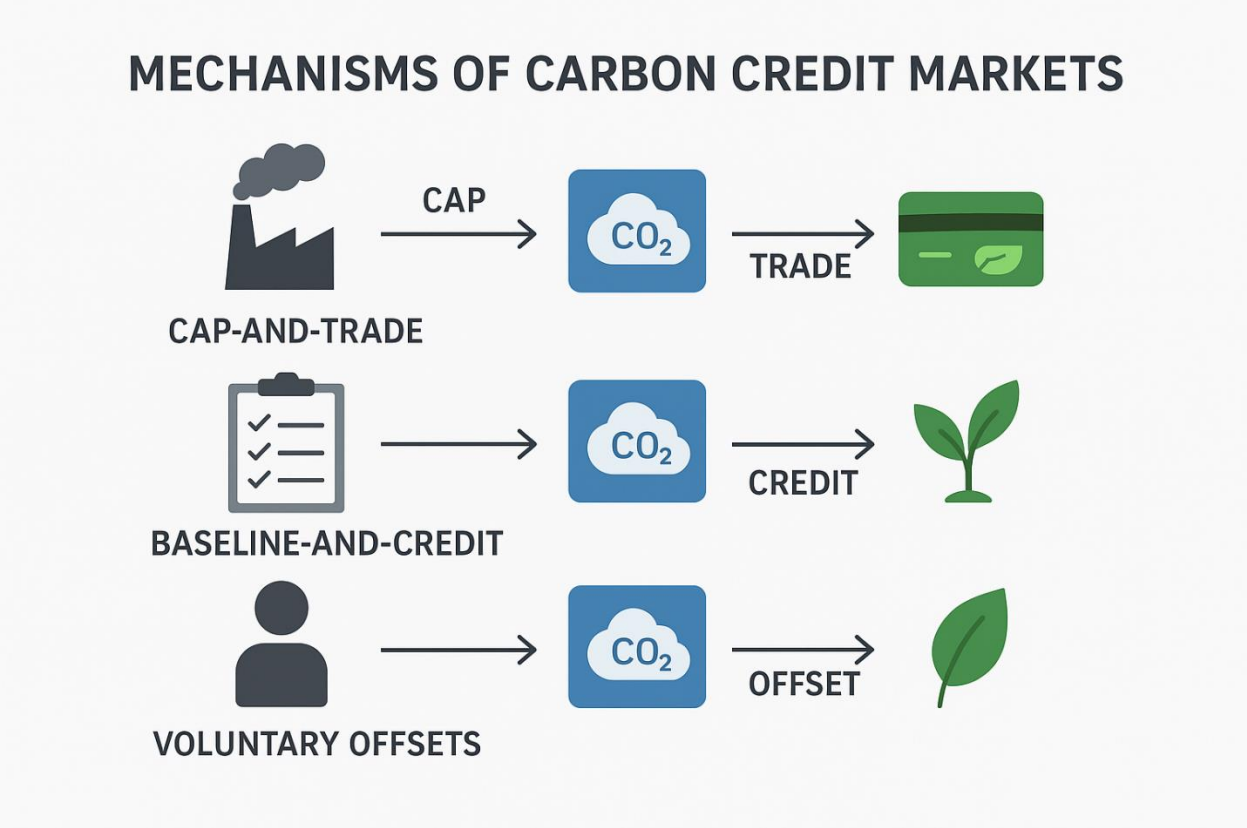

Figure 3: **Mechanisms of Carbon Credit Markets**

Source: (Donofrio & Procton, 2023; ICAP, 2023; World Bank, 2023).

This infographic demonstrates the three primary mechanisms of carbon credit markets: cap-and-trade, where the reduction is to be limited and exchanged on a market; the baseline-and-credit, where the reduction below a given base results in credits; and voluntary offsets, where the entities purchase credits to cover their emission levels. Combined these systems establish financial incentives to reduce greenhouse gases.

As the literature review explains Carbon credit markets are of two forms: compliance markets (including Emissions Trading Systems (ETS)) and voluntary markets. An example of compliance markets is introduced by having regulatory requirements imposed on particular sectors or companies to have emissions limits, and then the participants use these requirements by trading in carbon credits to fulfill these requirements. Instead, it is the voluntary markets, where entities can

voluntarily compensate through purchasing credits that are generated by projects that produce reductions in verified emissions, mostly as a result of corporate social responsibility, as opposed to a legal requirement. Carbon credits are generally expressed in terms of a unit of metric ton of carbon dioxide equivalent (tCO 2 eq) eliminated or captured and making it a quantifiable and tradable climate action unit (Netke, 2025). In January of 2024, 28 carbon trading markets have been reported established globally, which together cover about 17 percent of world GHG emissions (Sun et al., 2025). Generally, these markets are made to support the global energy transition, which focuses on the substitution of the dependency on carbon-based fuels to clean sources of energy, and they are programmed with the integration of socio-economic issues, making sure that they are equitable (Mankayarkarasi & Muruga, 2024). Carbon markets are relevant to the Pakistani situation because the latter is highly susceptible to the effects of climate change. Yet, Pakistan is one of the worst climate-exposed countries in the world, as floods, droughts, and heatwaves become a frequent hazard to the economic prosperity of the country, its food security, and the health of its citizens (Yousuf et al., 2014). In the scenario of Pakistan, the transport sector and the industrial sector are among the major contributors to the emissions profile. The transport sector, which has a high reliance on fossil fuels, is a leading contributor to CO 2 emissions and is marked by a high rate of vehicle ownership and use (Lin & Raza, 2020; Rasool et al., 2019; Raza & Lin, 2020). On the same note, the industrial sector that has been growing alongside investments in transport infrastructure and economic growth plans is a leading emitter, and energy-intensive manufacturing processes contribute to a significant amount of national emissions (Ahmed, 2023; Shahid et al., 2015).

2.5 Importance of Carbon Credit Markets for Developing Countries

The importance of carbon credit markets to the developing countries is not only in the fact that it is a tool of reducing emissions but also because it is a way of promoting economic growth, financial stability and sustainable development. The developing countries have the additional burden of lowering their emission levels and at the same time trying to achieve economic growth, unlike developed countries where most of the countries already have fully developed financial and industrial systems. Carbon credit markets offer a solution to both of these, establishing incentives

to investment sustainability, and connecting domestic climate policies and international sources of finance. (World Bank, 2023).

One of the most outstanding advantages is availability of climate finance. Developing nations could host renewable energy, forestry and energy efficiency projects under mechanisms like the Clean Development Mechanism (CDM) with billions of dollars paid by foreign investors. These were monies that would not have been available under normal development assistance. The financial patterns of the carbon market thus provide a new avenue in investment that is performance-driven and directly linked to the facts of reduction in emissions that are confirmed. (UNFCCC, 2023b). This financing is extremely important to countries with constrained fiscal capacities to address infrastructure gaps as well as energy transitions.

The other dimension is technology transfer. Among the technologies that are usually introduced in projects that are covered by CDM and are currently under voluntary carbon markets include solar power plants, waste-to-energy facilities, or even efficient cement kilns. To the host countries, this is not merely a short-term effect of the reduction in emissions; there is also the acquisition of new technologies, the development of local capacity to utilize the technologies, and the development of new technologies in home industries. In the long run, this leads to a larger modernization of the energy and industrial environment (Khan & Ali, 2020).

Socio-economic co-benefits are also created in carbon credit markets. The rural society which participates in reforestation projects is not only earning money with the sale of carbon credit, but also getting employment, better water preservation and maintenance of biodiversity. Renewable energy projects would, likewise, tend to increase the energy security and decrease reliance on imported fossil fuels. These results correspond to several Sustainable Development Goals (SDGs), such as poverty eradication, clean energy and climate action (UNDP, 2022a).

However, risks and challenges will not allow seeing the value of carbon credit markets in the developing countries. Monitoring, reporting and verification (MRV) systems are usually weak where there is a poor institutional capacity. Corruption, duplication of jurisdictions and absence of technical knowledge can dwindle investor confidence and restrict benefits that host countries can gain out of these markets (Doda et al., 2023). Moreover, the imbalance in the distribution of

projects has already been a matter of concern: e.g., a significant proportion of CDM projects has been concentrated in a handful of emerging economies like China, India and Brazil whereas smaller or less developed states have failed to attract similar investments (Winkelman & Moore, 2011).

These lessons are especially relevant to Pakistan. Being highly vulnerable to climate change, experiencing serious energy deficiencies, underdeveloped technological base, the entry into the global carbon markets is a strategic opportunity. By being able to access climate finance in these markets, the pressure on the governmental budgets might be reduced, and the transfer of technology might also assist in the modernization of the energy and industrial systems. Meanwhile, in the absence of governance issues and MRV gaps, Pakistan will not achieve the potential benefits.

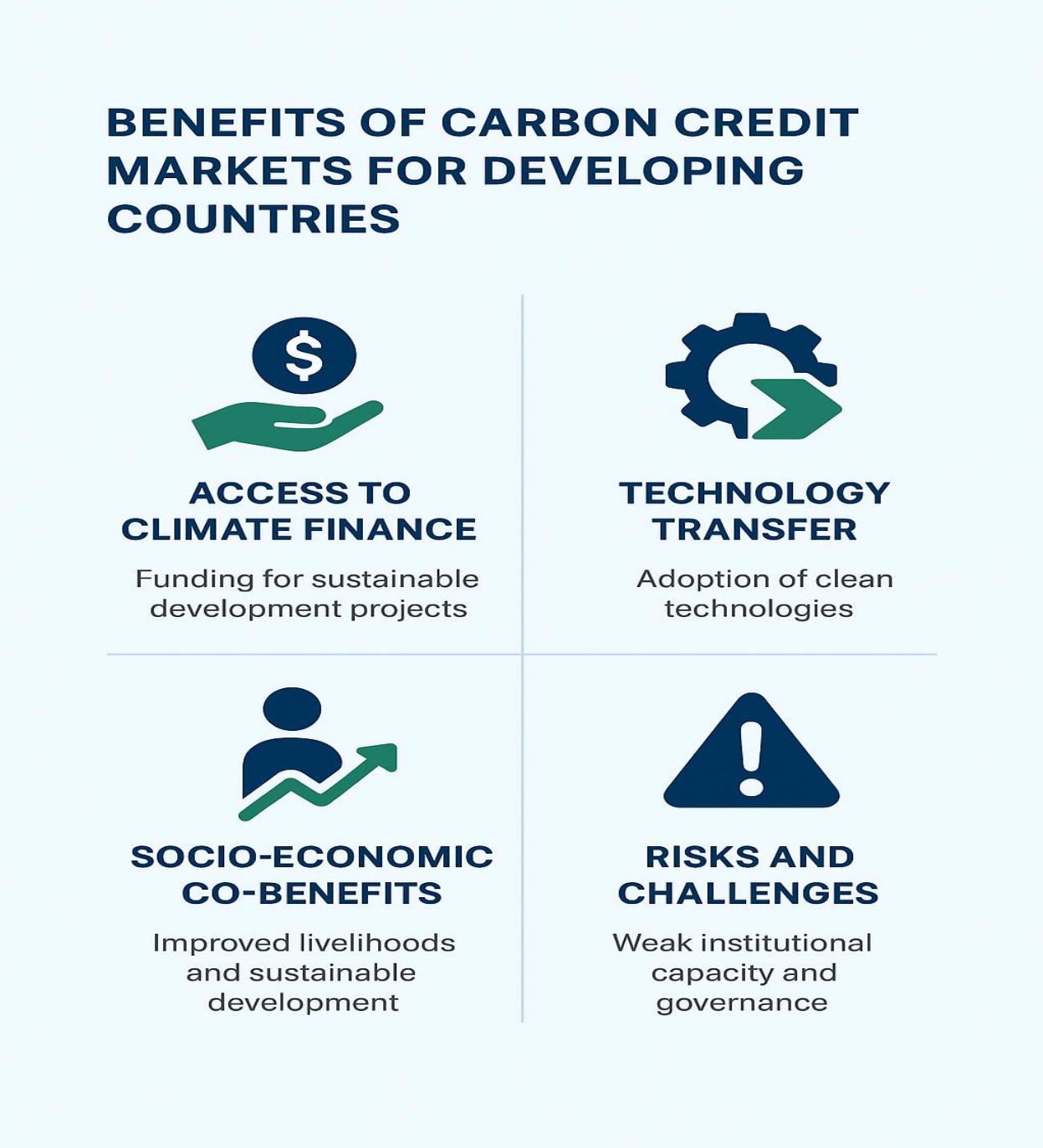

Figure 4: **Benefits of Carbon Credit Markets for Developing Countries**

Source: (Doda et al., 2023; UNDP, 2022a; Winkelman & Moore, 2011; World Bank, 2023)

2.6 Pakistan's Carbon Credit Market Context

Pakistan is in a distinct position in the world carbon credit market. Although the country is ranked among the most climate-vulnerable states in the world, it is contributing less than one percent of the global greenhouse gas (GHG) emission. Such disasters like the devastating floods of 2022 that left millions of people homeless and resulted in losses of over USD 30 billion emphasize the need to implement proper mitigation and adaptation measures. (World Bank, 2025a; World bank Group, 2024). In this regard, carbon credit markets represent a two-fold avenue: minimizing emissions and at the same time opening up novel sources of climate capital.

Relevance of such markets can be highlighted by the structure of the emissions of Pakistan. Recent estimates have found that the industrial sector makes up about 32 percent of the total GHG emissions, with the transport sector making up almost 28 percent. The two industries combined constitute the national emissions profile hence are the main targets of carbon credit interventions. (Climate Transparency, 2020; MCCEC, 2021). Energy intensive industries like cement, textiles and steel, in particular, use fossil fuels and the transport sector is typified by inefficient automobiles, infrastructural development and overdependence on the road transport.

Pakistan has also endeavored to make its climate plan consistent with international obligations. The government has committed to a conditional reduction of up to 50 percent of its estimated emissions by 2030 contained in its Nationally Determined Contributions (NDCs), conditional upon receiving international funds and transfer of technologies. In order to operationalize such ambitions, Pakistan Carbon Market Policy Guidelines (2024) was subsequently proposed offering a framework on participation in compliance and voluntary carbon markets. These principles underscore the importance of having powerful monitoring, reporting and verification (MRV) mechanisms, sector-based approach as well as liaisons between federal and provincial institutions.

Having these initiatives, there are still a number of serious challenges. Poor institutional capacity, disjointed governance, and absence of technical expertise are some of the barriers to the successful implementation of carbon market mechanisms. Awareness to the idea of carbon trading among the private sector is low and many firms are either not aware of the advantages of participating in the carbon trading or are hesitant because of uncertainty in regulations. In addition, the subsidy on

fossil fuels is still distorting the market and forming disincentives towards the use of renewable technologies.

Carbon credit markets are thus twice as significant to Pakistan. On the one hand, they introduce a crucial possibility to modernize industries, invite foreign investment, and cut the dependence on the use of external loans on climate-related projects. Conversely, Pakistan will be marginalized in the fast-growing global carbon economy unless structural weaknesses are resolved.

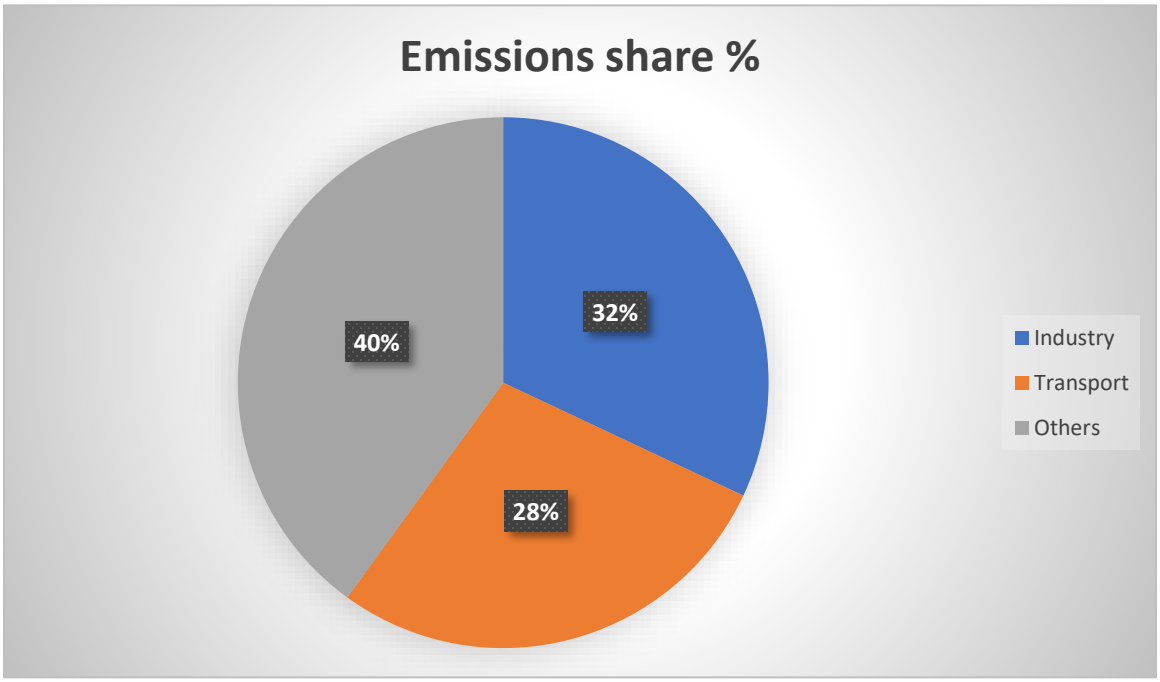

Figure 5: Pakistan's Sectoral Greenhouse Gas Emissions Profile.

Industry vs. Transport vs. Other industries, according to latest national forecasts.

Source: (MCCECGP, 2024; World Bank, 2023)

2.7 Pakistan's Carbon Market Policies and Critical Evaluation

Pakistan has made a number of moves in the last ten years to incorporate climate factors into its policy. However, the efficiency of these policies is low because of institutional and structural vulnerabilities. An increased examination of the climate governance of the country shows promising projects and some long-term issues that determine its willingness to be involved in carbon credit markets.

In 2012, the National Climate Change Policy (NCCP), which was updated in 2021, was the first to give a comprehensive vision of issues related to climate in Pakistan. It has highlighted the mitigation measures which include promotion of renewable energy, energy saving measures, and sustainable transportation. Although the policy had some high ambitions, it did not have proper financing mechanisms and enforcement strategies and thus its effect was restricted. In reality, however, a good part of the NCCP has been more of a dream on paper than a reality (Government Of Pakistan, 2021).

It also became a defining moment in 2017 with the formation of the Pakistan Climate Change Authority, the Climate Change Council, and the Climate Change Fund by the Climate Change Act of 2017. These organizations were supposed to organize policy, monitor project activities, and pull finance. Nevertheless, the authority has been experiencing shortage of resources and lack of coordination with provincial governments, more so in the wake of the 18 th Constitutional Amendment that decentralized the environmental concerns to the provinces (Khan et al., 2024). This fragmentation of the institutions is still a setback in the coherent climate governance.

The Nationally Determined Contributions (NDCs) that were submitted by Pakistan in 2021 constituted a significant international undertaking. The country stated that it would commit to a conditional cut of up to 50 percent of the expected GHG emissions by 2030, subject to receiving international finance, transfer of technology, and capacity building. This figure of 50 percent is subdivided into 15 percent unconditional and 35 percent external supported. These commitments may be ambitious but they demonstrate the dependence of the country on external resources and the constraints on its finances (UNDP, 2025).

The latest yet the closest relevant program is the Pakistan Carbon Market Policy Guidelines (2024), which is created with the participation of global partners. These provisions constitute a guideline on how to create compliance as well as voluntary markets. They lay stress on the role of monitoring, reporting, and verification (MRV) systems, implementation of industry-specific practices, and alignment of stakeholders. Notably, the guidelines are also aimed at ensuring that Pakistan is in tandem with global trends of carbon pricing, so that it can be a member of the emerging regional as well as global markets.

Although these advances have been made, there are a number of weaknesses that are critical. First, there is institutional fragmentation between the federal and provincial bureaucracies, and this leads to overlap of duties and inefficiency. Second, lack of technical expertise especially in MRV systems is a vice that undermines credibility and scares away investors in the country. Third, there are policy contradictions, i.e., the persistence of fossil fuel subsidies, which neutralize incentives toward the deployment of renewable energy. Lastly, the participation of the private sector also does not appear to be strong, as a lot of industries consider carbon markets to be complicated and inaccessible.

Thus, although Pakistan has succeeded in the formation of the policy framework of carbon credit market, it is highly reformed that it needs to undertake further measures to transform this framework into working systems. Engagement in global carbon markets will require institutions to be strengthened, technical capacity to be developed, conflicting subsidies to be eliminated and participation of the private sector in the market.

2.8 Pakistan's Readiness for Carbon Credit Markets: Insights from Literature.

The willingness of Pakistan to carbon credit markets has increasingly become the topic of scholarly and policy debate. Although the country has been interested in the incorporation of market-based mechanisms in the climate strategy, a more in-depth examination of institutional, financial, and sectoral aspects reveals opportunities and major challenges. This part is founded on secondary sources, and it gives a brief of Pakistan preparedness, by emphasizing on the key areas, institutional capacity, financial and legal preparedness, the voluntary carbon market role and the structural issues which define its place in the global carbon economy.

2.8.1: Sectoral Readiness: Industry and Transport

The greatest pollutant in Pakistan is in the industrial sector comprising of cement, steel and textile industries. Cement is a major contributor of carbon dioxide emission by itself both through use of fossil fuels and emissions as a result of the processes. In the meantime, textiles, which dominate exports in Pakistan are under growing international pressure over carbon transparency in supply chains as consumer's demand to know more about it. The Carbon Border Adjustment Mechanism (CBAM) of the EU is specifically applicable because it can include carbon tariffs on export unless plausible emission cuts can be proved (World Bank Group, 2022). Carbon credit opportunities are in energy efficiency upgrades, adoption of renewable energy and modernization of industrial processes. Nevertheless, huge initial investments, ignorance, and ineffective MRV systems are the impediments. (SABIR, 2024).

According to the literature the high-emission sectors have the potential to promote Pakistan into the international carbon credits market, as they can be used as centers of focus on emission reduction projects that can be used to generate tradable credits. This involvement may generate numerous sources of benefit as well, which would include direct monetary inputs, the use of cleaner energies, and industrial practices. Examples of histories, which can be used to demonstrate the possibilities of international cooperation and the transfer of technology with the introduction of market incentives for carbon reduction activities, are the participation of Pakistan in projects within the Clean Development Mechanism (CDM) of the Kyoto Protocol (Karp & Armour, 2009). Such experience underpins new mechanisms that can be developed, including those under Article 6 of the Paris Agreement.

Another key sector is the transport sector which contributes to about 28 percent of the emissions. It has been typified by old aged ships, low quality of fuel and excessive dependence on road transport. The quality of air in such large cities as Lahore and Karachi often becomes dangerous, so the improvement of transport is a significant issue (Aleksandra, 2020). The Electric Vehicle Policy (2021) in Pakistan has provided a gap to reduce emissions, and the possibility of establishing tradable credits in the event of the creation of MRV systems is obtained. Other things such as public transport projects and railways transitions can also help to decrease the emissions,

yet the institutional weakness and financial limitations still do not allow implementing a major change.

2.8.2: Institutional Readiness: Monitoring, Reporting, and Verification (MRV)

Carbon markets require credibility which is determined by the strength of MRV systems. MRV is poorly developed and divided between federal and provincial institutions in Pakistan. Data gathering is haphazard and the institutions lack coordination particularly after devolving responsibilities via the 18 th Amendment. The comparison with foreign experiences of the ETS in South Korea and the phased ETS in China shows that the standardization of methodologies and third party validation are essential (Hemmingsen, 2025a). Pakistan may end up on the periphery of global carbon trading unless major adjustments are made on its part because of doubts regarding the reliability of the data.

2.8.3: Financial and Legal Readiness

The climate finance situation in Pakistan is limited because it relies on foreign aid and has very few domestic resources. In spite of the fact that the National Climate Change Policy (2012/2021) and Climate Change Act (2017) provided the premise of legal systems, their enforcement is poor. The subsidies of fossil fuels that imbalances the prices of energy destroy the incentive towards renewable energy and efficiency programs (Khan, 2020). However, there are ways out: green bonds, blended finance, and cross-border partnerships may be used to mobilize resources required to scale up carbon market participation.

2.8.4: Voluntary Carbon Markets in Pakistan

Voluntary markets provide a new avenue to Pakistan. Potential projects that can help in creating voluntary credits sold to other corporations to off-set emissions include forestry and renewable energy projects. The interest in the private sector has already been noted early, especially in the renewable energy developers and the companies associated with the global supply chains. Nevertheless, voluntary markets entail credibility by having strong project design, validation and verification, which Pakistan yet again lacks knowledge and capacity gaps (Hemmingsen, 2024).

2.8.5: Challenges and Barriers

Although there are opportunities, the institutional structures and weak technical capacity of Pakistan hinder its preparedness due to the lack of governance. Policy contradictions, including encouraging renewable energy and subsidizing fossil fuels also hamper the coherence. There is weak involvement of the private sector, ignorance, and poor MRV systems that have aggravated the situation. The above issues indicate that although Pakistan has established a basis of policy, it still needs to make significant reforms that can help translate ambition to practice.

According to the literature on a financial level, there is even the hope of foreign investment and revenue in the sale of verified emission reductions by joining carbon credit markets. These financial flows might be channeled into green sustainable development agendas such as job creation, emerging local entrepreneurship, and the flourishing of green initiatives (RASTOGI, 2024). Additionally, a strategic investment of the revenue stream of carbon credits in such a way that mitigates emissions in combination with creating climate resilience would induce a virtuous cycle of low-carbon development. Looking at its sector-by-sector, there can be a decarbonizing push with the support of carbon markets. Through direct payment of a specific price on carbon emissions, the markets work to encourage the use of cleaner technologies, not only in industrial machines that consume a lot of energy but also in transportation using environmentally friendly alternatives. In the automotive industry, such a switch to electrified vehicles (EVs) is regarded as one of the key factors towards meeting the so-called “double carbon” initiatives of carbon peaking and carbon neutrality, a shift that other countries have developed policies strongly towards, and its potential can be equally great in the Pakistani case (Li & Tang, 2017;Wu et al., 2025). Emission abatements in the power sector, as well, are a large field. Since this sector is a major contributor to GHG emissions in Pakistan, carbon market mechanisms can help to balance it to use renewable energy sources, including wind, solar, and hydro energy and improved energy efficiency (Yousuf et al., 2014), can help it achieve GHG emission reductions in Pakistan (not to mention energy security, less reliance on imported fossil fuels, and thereby creation of new economic opportunities). Such areas require immediate improvement, especially in the transport sector. It is projected that the total number of vehicles in Pakistan will exceed 52.5 million by 2040, which represents more than twofold increase as compared to 2020, with the most critical surges in

motorcycle ownership, as it is predicted to rise to 44 million units during the same time range (Butt & Singh, 2023). This trend can consequently generate increased transport-related emissions, which defines the necessity of low-carbon transportation solutions implementation. The carbon credit markets provide a policy to provide the pushing factor towards the use of such solutions, such as EVs, better transportation systems, and non-motorized transport infrastructure.

The potentials created by the involvement of Pakistan in carbon credit processes are far more than just the financial processes since they also relate to the wider areas of development, technology, and policy. On the most near-term level, the auction of carbon credits provides an avenue through which to earn foreign exchange and, at the same time, open up domestic investment in climate-friendly infrastructure. As (RASTOGI, 2024) notes, climate financial inflows generated by the sale of credits can be a lifeline to developing economies, especially for limited economies, because these economies will be able to achieve low-carbon development without jeopardizing other intentions of national growth.

The Clean Development Mechanism has such historical mechanisms that provide evidence on how they could be exploited to offer not only environmental but also economic advantages. (Karp & Armour, 2009) candidly opine that its predecessors of the CDM lent emerging carbon markets the chance to utilize global capital to finance local technology implementation, where they cleverly embraced innovation on emission limitations as part of the green initiatives. In the Pakistani setting, these mechanisms have the potential to fill the policy aspiration to execution divide, as policies to decarbonize Pakistan are economically viable and operationally feasible.

Decarbonizing the transport and industrial sectors of Pakistan is one of the most appealing sector-specific opportunities in the context of Pakistan. According to (Li & Tang, 2017), the adoption of carbon trading schemes will directly alter the behavior of companies and industry sectors because those schemes make carbon cost an element of production and investment choices. This is possible in the transport industry, which is likely to spur the journey towards low-emission mobility solutions, including electric vehicles, hybrid systems, and enhanced mass transport alternatives (Wu et al., 2025) highlight the relevance of the automotive sector as a significant carbon emitter in the world today and the need to design policy frameworks that promote the transition towards a green goal of achieving a “double carbon” agenda. Extrapolating the use of the strategies in

Pakistan would make its transport system a leader in the low-carbon mobility innovation across the region.

Mitigation opportunities in the industrial sector are also imminent. The steel, cement, and textile industries are also power-intensive heavy industries and make significant contributions to the carbon footprint in Pakistan (Ahmed, 2023). It might be possible to make these industries more environmentally friendly through the carbon market incentives, including energy-efficient kilns and eco-friendly cement products, or renewable-powered machinery in textiles. (Yousuf et al., 2014) report the potential to reduce emissions in the Pakistani power generation, which is highly associated with industrial activity, as the sector can be technologically as well as significantly reduced in carbon intensity through the use of alternative and new technologies.

The key role in achieving these opportunities is technological innovation. Carbon markets can enable research, development, and deployment of new technologies in various sectors by creating price signals. Regarding transport, (Butt & Singh, 2023; Kumar et al., 2024) point to the rapid emergence of electric vehicles and associated charging infrastructure as key factors in the process of cutting oil dependence and emissions. (Liu et al., 2023) Also emphasize the breakthroughs and growth in battery technology and energy storage systems as policies to underpin the large-scale movement towards renewable energy integration, both on the move and at fixed locations. Such innovations may be related to carbon credit revenues directly, either in a program of re-investment that is publicly handled or a market-driven form of financing in the privately owned sector.

Such interventions are urgent, as the projections of the transport sector growth outlined by (Butt & Singh, 2023). The predicted rise in vehicle ownership and specifically motorcycle ownership leads to a two-fold challenge: a need to support growth in mobility in addition to preventing a similar rise in emissions. Unless moderate mitigation policies are adopted, the high rate of motorization in Pakistan is likely to cancel out all the advances made through other emission reduction strategies. The possible tool to solve the problem is the carbon markets, since low-carbon alternatives are proposed to be made economically profitable to both producers and consumers. To give some examples, subsidies or tax exemptions in the name of EV acquisitions might be paid out of the carbon credits they sold, and industrial companies might be encouraged to switch their fleets to electric or to efficient logistics-wise solutions.

Another important opportunity, which is related to the carbon markets, is increased energy efficiency. In support, Acheampong et al. (Acheampong et al., 2020; Ali et al., 2025) reveal that financially advanced markets, such as better access to credit, have had a positive association with declines in carbon emission intensities. By implying that the higher the financial capacity of the firms to invest in greener technologies, the more likely they are to make this transition, especially when the policy is there to offer some incentive to these investments. The position of green credit policies is also noted (Liu et al., 2023), which can reduce the entrance cost of projects targeting energy efficiency and the inclusion of renewable energy sources in an industrial process.

Lastly, the participation in carbon markets would put them in tandem with international climate governance processes, such as Article 6 of the Paris treaty. According to (Deng et al., 2022; Li, 2024), Article 6 lays out collaborative methods of carbon trading and offers a mechanism of sustainable development capable of assisting in the exchange of mitigation results across borders. Through involvement in such mechanisms, Pakistan not only has a chance to capitalize on its emission cuts but also has access to global best practices, capacity-building activities, and technological transfer opportunities that have the potential of strengthening its overall climate policy framework.

Although the possible gains associated with the entry of Pakistan into the internationally operating carbon credit system are immense, the country is also subject to various structural, institutional, and technical issues, which can undermine the proper formation and functioning of the mechanisms. Such difficulties are not exclusive to Pakistan or are not insoluble, but policymakers need to focus their policies and, most importantly, allocate resources to take Pakistan to the full potential that carbon markets hold.

Among the main obstacles that exist is that there is no strong legal and institutional infrastructure that could support a transparent and credible carbon market. (Tanveer et al., 2024) Note that in most developing nations, it is difficult to put in place the requisite infrastructure to facilitate successful carbon trade, like a clear legal framework, enforcing mechanisms, and governance frameworks. The risks of these foundational elements not meeting the market can be devastating to the confidence of the market and, domestically, as well as internationally, investors. According to (Deng et al., 2022), the integration of various management systems and the existence of

systematic rules of implementing the emission regulations must be in place to guarantee that the laws of carbon trading are implemented efficiently, without fraudulent practices, and uphold the environmental integrity of the issued credit.

The other challenge is the difficulty of assessing emission reductions based on measuring, reporting, and verification (MRV). MRV systems are, in fact basis of any credible carbon market because they present the data to quantify and certify the emission reductions, which are the basis of tradable credit. To the author, the argument is that without strong MRV procedures, carbon markets are in danger of being compromised by distrust as players may have no guarantee that the reduction may not exist, not additional, and not permanent (Wu et al., 2023). The urgency of this matter is especially high in the transport sector of Pakistan, since the emissions found in this specialized area are both high and cannot be easily tracked because of the variety of different types of vehicles, fuel production spheres, and usage patterns (Edelenbosch et al., 2024; Smith et al., 2024).

Emissions generated in the transport sector become an MRV issue of concern due to their diffuse nature. Although emissions made by huge stationary sources, like power plants or industrial factories, can be tracked rather easily, transport emissions are produced by millions of vehicles that travel under various conditions. This issue is then exacerbated in Pakistan due to the booming vehicle ownership rates and the dominance of older cars, whose efficiency is low and is not equipped with modern emissions-controlling mechanisms (Rasool et al., 2019; Raza & Lin, 2020). Building an effective MRV system in transport may well necessitate a very costly investment in digital tracking, integration of fuel sales records, and roadside emission measurements, none of which are so far in place on a large scale.

Within the realm of the industrial sector, MRV has its complexities of its own. A major part of the industrial plants in Pakistan is of a small-scale nature, with a low technical capacity to measure emissions. Besides the fact that it increases the possibility of inaccurate reporting, it also creates a burden to the regulatory agency charged with monitoring compliance. In addition, not all industries will be willing to be fully involved in carbon markets in case they believe that MRV is too complex or expensive to follow. This brings the necessity of MRV methods to be adjusted to suit the specific (and not so specific) circumstances, which must strike the balance between rigor and practicality,

and can, in fact, involve the use of sector-specific procedures, or use established infrastructures of data collection, to minimize the cost of compliance.

The monetary limits are also a great inhibition towards engagement in carbon markets. Although in theory, carbon credit revenues can raise enough funds to finance the emission reduction activities, most of these activities entail massive initial funding, which might be out of reach of Pakistani companies. According to (Acheampong et al., 2020; Ali et al., 2025), access to finance is one of the key facilitating factors of low-carbon investment, but the financial markets in Pakistan are not fully developed in this aspect. The policies of green credit outlined would potentially allow closing this gap, although they would require adherence to a more comprehensive strategy of climate finance to be efficacious.

Another demographic of concern is institutional coordination. Carbon markets must be cross-sectoral in principle since a reduction in one sector can be sold to another, offsetting in a different sector. Institutional silos in most cases, restrict information flow and coordination policies in various departments and government agencies in Pakistan. The Ministry of Climate Change might set high targets of emission reduction; however, coordinated efforts with Ministries of Energy, Transport, and Industry might not be attained. Such coordination failure may also result in patchwork policies like subsidies on fossil fuel consumption, which collide with the price of carbon.

Lastly, awareness about carbon markets is minimal in Pakistan among the populace and the stakeholders. Unless the carbon pricing efforts are accompanied by widespread knowledge and support, the programs are likely to struggle due to their opposition by the industry stakeholders and lay audiences, especially when the prices are seen as rising expenses without providing a noticeable value. Creating awareness by reaching out specifically and implementing capacity-building tools will therefore be critical towards the buy-in by all the concerned actors.

Both the benefits and the strong points of carbon markets, as well as their obstacles and complexities, are all that can really help analyze how Pakistan can fit strategically into the global carbon credit system rather more complicated. This one should be well-detailed because before integrating into full-scale market participation, there has to be a pursuit of the reforms of policy and institutional structures.

Policy alignment will be of importance. The participation in carbon markets in Pakistan must be linked to its overall climate change strategy, as it should never supplement or sink the current mitigation policies. As an instance, the carbon pricing can be aligned with the renewable energy targets, modernization plans of the transport sector, and the energy efficiency programs. Such a multi-dimensional policy approach would not only help to improve policy coherence but also permit the potential of each of the measures, as far as their potential emission reduction is concerned, to be maximized.

Development of the institutional capacity is also of significance. The regulatory bodies have to be provided with the technical capacity, personnel, and resources to come up with the design the implementation, and monitoring of the carbon market activities. They can incorporate the creation of MRV protocols, which further join the economic and technical conditions of Pakistan, systems of issuing credits, monitoring of credits, and their retirement, which fulfill the international priorities. Experience of other jurisdictions, as noted by (Sun et al., 2025; Yang & Zeng, 2025), demonstrates that the early investment in institutional infrastructure is worthwhile when it comes to stabilizing the market and confidence of investors.

2.9 Lessons for Pakistan from International Experiences

The world practice of carbon markets has much to offer Pakistan as it attempts to have its own mechanisms. Europe, Asia, Africa and Latin America have tried emissions trading schemes (ETS) and voluntary carbon markets and can provide insights into both best practice and traps to avoid. Although it is impossible to directly transplant any of the models, the comparative review indicates that there are major principles that can be used in the policy and institutional design of Pakistan.

2.9.1: European Union Emissions Trading System (EU ETS)

The biggest and most established carbon market in the world is the EU ETS that had been launched in 2005. This has enabled its success due to the existence of clear legal frameworks, robust MRV systems and political commitment (ICAP, 2023)**.** In the case of Pakistan, the EU ETS emphasizes on incremental introduction, namely, introducing the energy-intensive industries to the phased introduction. Another issue that is highlighted by the EU is that market stability mechanisms must be established to avoid extreme price fluctuations.

2.9.2: China's National ETS

The largest ETS in the world was launched by China in 2021 and, at first, it focused on the power sector before moving to other industries. The Chinese approach shows the usefulness of sectoral piloting whereby the biggest emitter sector is targeted, and experience is gained firstly before generalizing. In the case of Pakistan, an entry mode that would be manageable would be piloting an ETS in cement or textiles. Additionally, China focuses on capacity building and data quality control, which can be discussed as a lesson to strengthen MRV infrastructure (ICAP, 2025).

2.9.3: India's Perform, Achieve, and Trade (PAT) Scheme

The PAT scheme in India is one that trades credits on improvement of energy efficiency. It has made some energy savings by cutting down certain industrial sectors; this has created awareness in firms. The major lesson that can be taught to Pakistan is that it is indeed in their own interest to connect carbon credits with such co-benefits as energy security and cost reduction, where non-compliance industries may find the participation appealing (Sarangi, 2020).

2.9.4: Brazil and Forestry-Based Offsets

Brazil has used the huge forestry resources to engage in the voluntary carbon markets especially in the REDD + project (Reducing Emissions through Deforestation and Forest Degradation). In case of Pakistan, which also possesses a great possibility of reforestation and afforestation, the

experience of Brazil demonstrates the need to make sure that the community is involved and the social and environmental integrity is not compromised during forestry offsets (VERRA, 2025).

2.9.5: South Korea's ETS

South Korea has developed a strong compliance market by engaging the private sector early and providing incentives for participation. Its reliance on public–private partnerships (PPPs) in building MRV systems and financing low-carbon technology adoption offers a useful model for Pakistan, where government capacity is limited and private sector buy-in is crucial (ICAP, 2023).

2.9.6: African Regional Experiences

Other countries like Kenya and South Africa have been involved in voluntary and compliance markets and in most cases, they have used international finance to develop capacity. The cases highlight the importance of international collaborations in eliminating financial and technical hurdles. In the case of Pakistan, the cooperation with the multilateral bodies and the donor agencies will be required to obtain the technical knowledge and financial resources (World Bank, 2024).

2.9.7: Key Lessons for Pakistan

Enabling Pakistan to have a successful carbon market approach should continue by initially having pilot projects in high emitting industries like the cement industry, textile industry and transport and then gradually increase the entire economy into a system. Monitoring, reporting and verification (MRV) systems should be strengthened to ensure credible data collection which is transparent and robust, and undertaken internationally. The private sector has to be appealed by design of incentives that emphasize cost efficiency and increases in export competitiveness and make use of co-benefits of carbon markets in energy efficiency, pollution alleviation and wider social benefits. Moreover, the transition could be hastened by gathering international support in the form of climate finance, technical expertise and donor assistance. Last but not least, inclusivity should be encouraged and in this regard forestry efforts and community-based projects should involve local communities and offer fair distribution of benefits.

As in the literature these are explained like internationally, Pakistan has an opportunity to engage in collaboration with other countries in the establishment of MRV systems in complex industries like transportation. Technology transfer and capacity building could be in the form of a partnership with the countries that have introduced similar systems, thereby saving time and expense of establishing the systems in the countries.

The financial mechanisms will also be instrumental in getting out of the capital limitations. The upfront capital that would be required to undertake emission reduction projects might be availed by setting up green finance sources using international climate funds or development banks. Such facilities may be associated with carbon credit revenues, and this connection makes a sustainable funding scheme, where market earnings are used to fund new mitigation projects.

Lastly, there should be no neglect of the involvement of the people. Clear communication on the objectives, advantages, and how carbon markets work can also be used to create trust and buy-in among stakeholders. Market mechanisms do not have to be viewed simply as regulatory tools imposed by the state; public education campaigns, combined with deliberative policy formulation exercises, can help to instill a sense in them that they are actually an opportunity that can provide mutual advantage.

Despite the legitimization of the structures, opportunities, and drawbacks of carbon credit markets having significant coverage on the international academic research front (Abrahao et al., 2023; Sun et al., 2025; Yang & Zeng, 2025), there is no specific sectoral study on the Pakistan industry and transport sectors regarding these market mechanisms. Although research records show that Pakistan has been highly vulnerable to climate change and has a high rate of emissions due to energy-intensive industries (Ahmed, 2023; Lin & Raza, 2020; Raza & Lin, 2020; Shahid et al., 2015; Yousuf et al., 2014), it has not studied adequately on how the energy-intensive industries can find a place in compliance or voluntary carbon market. The literature on this topic says something about the adoption of technology, development of emission trends, and sector issues (Butt & Singh, 2023; Kumar et al., 2024; Liu et al., 2023), however, none of them directly relate this to the technical aspects of entering the market, which involves developing effective MRV systems (Wu et al., 2023) understanding how national frameworks align with the mechanisms incorporated in Article 6 of the Paris Agreement (Deng et al., 2022; Li, 2024). Through this, it is

not well comprehended how Pakistan can decarbonize its industrial and transport sectors using carbon credit mechanisms through institutional, financial, and governance conditions.

As pointed out in this literature review, international experience demonstrates that carbon markets have developed considerably both in the category of compliance and in the category of voluntary methods (Sun et al., 2025; J. Wu et al., 2023). Pakistan, on the other hand, is only at the initial phases of developing a formal carbon credit market. Sector studies point out that the transport sector is a formidable and increasing source of national CO2 production (Rasool et al., 2019; Raza & Lin, 2020), and industrial growth has been directly and famously linked to the growth of carbon footprints (Ahmed, 2023). It has been found that the concept of electric vehicles has the potential to transform the transport-related emissions through mitigation pathways, although policy design and supporting infrastructure are lacking (Butt & Singh, 2023; Kumar et al., 2024). Regardless of such contributions, little scholarly work has evaluated the institutional, financial, and policy preparedness of Pakistan to engage successfully in the carbon credit market. Despite the fact that recently the federal government accepted the Carbon Credit Guidelines (2024) to offer a policy framework (Gov.Pakistan, 2024; Hemmingsen, 2025a)there is limited research that critically analyzes the alignment of the guidelines with the preparedness of the transport and industrial sectors. The absence of such an examination highlights the value of the current research, which aims to qualitatively evaluate readiness issues and opportunities in these two high-carbon sectors, thus providing practical suggestions on how to make Pakistan's carbon market development consistent with developing global best practices.

Moreover, although, lack of infrastructure (Tanveer et al., 2024), financing (Acheampong et al., 2020; Ali et al., 2025), technological gap (Li & Tang, 2017; Wu et al., 2025) barriers are recognized, there is a lack of qualitative studies that inform the views of policymakers, industry leaders, and transport sector stakeholders on the way of overcoming these limitations in International experiences provide precedents on how socio-economic factors can be incorporated into a market design (RASTOGI, 2024), although it is not clear how well it could apply in the Pakistani setting with its policy, economic, and infrastructural circumstances. This disparity brings into focus the required context-sensitive and focused studies to fill the gap between global best

practices and Pakistani-specific environments to help establish a workable roadmap of integration of the country into the international carbon credit mechanism.

2.10 Theoretical Framework

This research paper has been based on three complementary theoretical lenses, namely Institutional Theory, Environmental Governance Theory, and Market-Based Environmental Regulation Theory that present in totality the role of policy design, institutional capacity and market mechanisms in the development and effectiveness of carbon credit markets within developing countries like Pakistan.

The Theory of Institutional (North, 1990; Scott, 2008) acknowledges the influence that formal and informal institutions, i.e. laws, policies, norms, organizational structures have on the behavior of actors and effectiveness of policy making. The theory, in relation to this study, was used to describe how the institutional fragmentation of Pakistan, poor coordination between the national and provincial governments and lack of technical capacity limit the realization of a carbon credit market. Carbon trading schemes require strong institutional frameworks in order to enforce credibility and stakeholder involvement.

Environmental Governance Theory offers a more extensive analytical frame of reference of how various actors are, that is, state institutions, the private sector, and the civil society, to deal with the environmental challenge. Good governance implies transparency, accountability and coordinating systems like Monitoring, Reporting and Verification (MRV) systems which guarantee integrity and trust in market-based instruments. In the case of Pakistan, this theory assists in the formulation of the necessity of cross sector cooperation and stakeholder involvement in the process of implementing carbon market policies in accordance with international standards.

The economic explanation of carbon trading is based on the Market-Based Environmental Regulation Theory. It holds that the goals of the environment can be fulfilled more effectively using financial rewards and market systems than using the conventional command-and-control regulations. In this sense, the carbon credits and emission trading schemes generate price signals which will induce industries to cut their emission at lower costs as well as foster innovation and green investment. This theoretical prism in the scenario of Pakistan helps to explore carbon credit

markets as an instrument in the context of attracting private investment, encouraging energy efficiency, and sustainable development of industrial and transport in the country.

These theoretical views combined give a holistic approach to the analysis of the preparedness of Pakistan to participate in carbon markets. They emphasize interactive relationship of the strength of institution, quality of governance and market efficiency thus providing an organized framework of understanding the opportunities and challenges found in this study.

2.11 Conceptual Frame work

The literature review demonstrates that institutional, financial, technical, and policy issues limit the potential penetration of Pakistan into carbon credit markets. The causal relationship thus works between independent variables (institutional capacity, MRV systems, financial preparedness and stakeholder engagement) and the dependent one (Pakistan readiness to participate in carbon market in the industrial and transport sectors).

Institutional Capacity -Good governance systems, organizational linking of the federal and provincial agencies, and regulatory mandates will play a vital role in a plausible market system. The failure of weak institutions to duplicate, inefficient and weak enforcement threatens the institutions ability to interact with other states in the international arena.

Monitoring, Reporting and Verification (MRV) Systems - A good MRV system offers transparency and credibility in terms of the emissions reductions. There is experience in the international arena that the reliability of data is the foundation of carbon trading, and the MRV infrastructure in Pakistan is decentralized and poorly developed.

Financial and Legal Framework- Availability of climate finance, green investment and enabling legal frameworks are important facilitators. Pakistan will be unable to attract investors and come up with projects to comply with and voluntary markets without sustainable funding and enforceable rules.

Stakeholder Engagement- The key players are the private sector, the people, and foreign donors. Engagement will give incentives to industries, will be inclusive, and will enable the use of the best practices.

The four variables come together to establish the willingness of Pakistan to participate in the carbon market, particularly in the high emitting areas (industry and transport). According to the framework, the readiness will be directly improved through the strengthening of the institutions, MRV, financial/legal mechanisms and the collaboration of stakeholders, which will help Pakistan to pass the nascent voluntary market to the effective compliance market that will meet the global standards.

Based on these observations, the next chapter lays out the methodological basis that was followed to examine these variables and measure the readiness of Pakistan to participate in the carbon market.

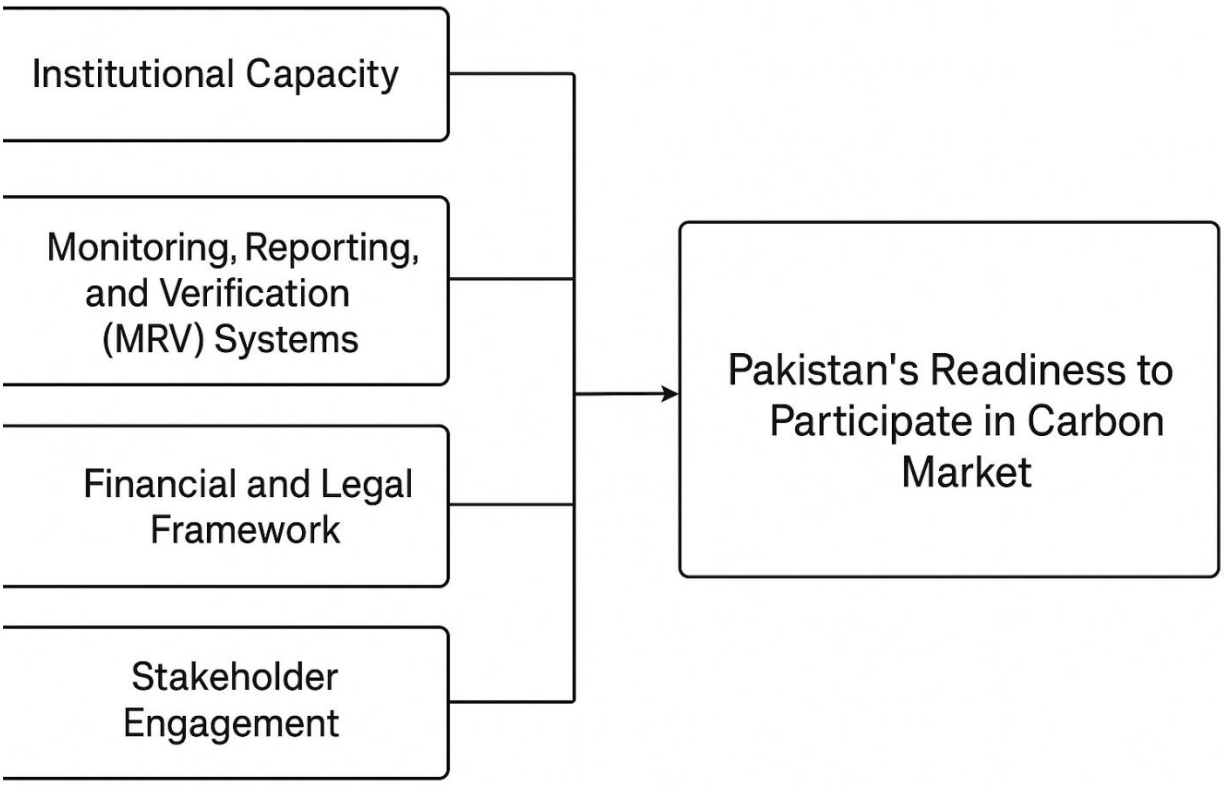

Figure 6 : **Conceptual frame work flow diagram**.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In this chapter, the adopted methodology of study is presented. It presents the general research design, sampling approach, data collection methods, document review, data analysis methods, ethical, and the research site and finally how these approaches improved the reliability and validity of the research. The study particularly addresses the prospects and issues of the implementation of a Carbon Credit Market (CCM) in Pakistan, and in particular the transport and industrial sector. A qualitative research design was chosen because this scheme allows the research to identify the policy, institutional, and sectoral dynamics when formulating and implementing carbon market initiatives (Mack & Woodsong, 2005). The approach will be based on semi-structured interviews accompanied by document analysis, which will enable both exploring the views of the stakeholders and policy frameworks in detail. This combined methodology also increased the richness, relevance and validity of research findings to policy situations.

3.2 Research Design

The research design used in the study is a qualitative case study, the areas of concern were the industrial and transport sectors of Pakistan, and which is appropriate where an in-depth study is required of a complex dependent phenomenon like the developing carbon credit market in Pakistan (Baxter & Jack, 2008; Yin, 2018). As far as the country in question has limited experience with CCM and the few empirical investigations have not been done on the topic, a case study method will enable examining the practical institutional environment, perceptions of key participants, and challenges to implementation in great detail.

The study design aims at mapping out any emerging opportunities, as well as policy and institutional preparedness, and sectoral participation and implementation issues. It is based on the assumption that the analysis of the lived realities and institutional experiences of those actors that play a decisive role in the CCM shall provide valuable insights into the policy-making space and future development thereof.

3.3 Sampling Strategy

A mixed sampling design was used, where purposive sampling and the snowball sampling method were used to find out the most suitable individuals with profound experience in carbon governance and the Pakistani sectoral realities.

The purposive sampling focused on targeting individuals and organizations known to have been involved in the development and verification of carbon credits and/or the making of national policy in the area of carbon credits (Etikan et al., 2015; Palinkas et al., 2015). These involved representatives of the previously mentioned people working on the Ministry of Climate Change and project developers, MRV consultants, and the people involved in the high-emitting sectors, like the private sector and transport sectors. Some of the respondents were reached through professional networks and facilitating people who were the supervisor and colleagues of the researcher. This multi-layered approach gave the people and the private sector a voice and credibility to the study.

Snowball Sampling was employed to widen the list of respondents to be used by seeking the assistance of the original participants in finding others who have relevant knowledge (Nikolopoulou, 2022). The plan worked especially well in targeting the technical experts, consultants, and stakeholders in initiatives that do not receive much publicity in regards to carbon.

Such a multilayered sampling structure will represent both the public and the private sector and encompass a wide scope of views related to various strata of the Pakistan carbon credit ecosystem.

Purposive and snowball sampling were the most suitable in this research since the study population was a small and specialized group of stakeholders with first-hand engagement or expertise in the policy of carbon markets, the industry, and transport sector. These people cannot be easily recognized using common sampling frames and thus random sampling is not viable. The purposive approach to sampling was used to make sure that only the participants with the corresponding knowledge and experience were involved and snowball sampling was used to increase the pool through professional referrals of the initial participants to generate more eligible respondents. This mixture allowed the researcher to get a wide but knowledgeable array of views to comprehend a complicated institutional, policy, and technical aspects of the Pakistan carbon credit market.

3.4 Data Collection Methods

3.4.1 Semi-Structured Interviews

The main instrument of primary data collection in this research work was semi-structured interviews. This process has both consistency and flexibility in probing and helps to delve into the important issues of Directives on the project design and regulatory support of the CCM policy formulation in the national context, Roles and mechanisms of coordination of institutions, Sector-specific licensed forms of barrier and opportunity, MRVs and the issues of verification, and Involvement of stakeholders and sensitization.

Interview questions were asked from Officials of the Ministry of Climate Change, the representatives of national environmental organizations, project developers, consultants concerned with carbon credit certification, and the experts of the transport and industry sectors. The familiarization with the topic of the interviews has helped participants to expound on the experiences they had, their perceptions, and concerns.

Informed consent was acquired for all interviews. Where permitted, interviews were audio-recorded, then transcribed and anonymized. In other cases, detailed notes were taken during or immediately after the interview to ensure accurate representation of responses and maintain research integrity.

3.4.2 Sample Characteristics

The researcher used purposive sampling to make sure that the respondents reflected a wide range of institutional and professional affiliations directly involved in the climate policy, carbon markets, and sustainability practices in Pakistan. A total of fifteen semi-structured interviews were carried out with professionals who work in government, industry, transport, research as well and consultancy sectors.

3.4.2.1: The participants included:

Government officials, including a Section Officer (Carbon Markets) of the Climate Ministry, a female officer, and an Environmental Inspector a male officer of the Environmental Protection Agency, and a senior Lab male officer of the Environmental protection Agency Islamabad, they described the policy, and regulatory aspects of carbon markets and the challenges of the transport and industry sector in managing emissions.

The industry representatives, such as a Direct Sales Manager, male, from Dugasta Properties, a Project Sales Manager, male, from Sky Electric Islamabad, and a Compliance/Sustainability Officer, male, from GIZ Pakistan, who provided input on the question of industrial practices, corporate sustainability, and readiness of the private sector to participate in the carbon market.

Transport sector professionals, such as Transport Planners and Policy, male, Officers, of the National Transport Research Center, Islamabad, and one other male officer from government Transport department (hidden his post on his request), who explained the constraints specific to the sector, the role of modal shift policies, and whether transport institutions are ready to embrace a role in the carbon market mechanism.

Research and academic experts, such as Research Associate, male, of IPRI, Senior male Economist of the Communication and Works Department, government of the Pak, and Senior Male Economist of NESPAK, who provided advice on economic modeling, technical analysis, and applied research.

Independent experts and consultants, including a Sustainability Expert, female officer of JK Spinning Mills Limited, a Technical Consultant, female officer of GGGI/UNEP-CCC (SPAR6C Project), and a Chief Executive Male Officer, of Hawkeye Engineering Private Limited, and a female officer of SDPI of a sustainability-oriented organization, were consulted on voluntary and compliance carbon markets with specific knowledge and strategic outlooks.

The demographic composition of the respondents included both middle career and senior professional experience in industry, transport, government, and academics, which guaranteed the appropriate balance of technical and policy experience, as well as industry views. The sample was

not random but was designed to represent the spectrum of stakeholder opinions that were required to provide an in-depth qualitative analysis of the preparedness of Pakistan in the industrial and transport sectors towards carbon credit markets.

Table 4: **Summary of Sample Characteristics**

Category	No. of Participants	Example Roles/Institutions
Government Officials	3	Section Officer (Carbon Markets, MoCC), Environmental Inspector (EPA), Senior Lab Specialist (EPA
Industry Representatives	3	Direct Sales Manager (Dugasta Properties), Project Sales Manager (Sky Electric), Sustainability Officer (GIZ)
Transport Sector Professionals	2	Transport Planner & Policy Officer (National Transport Research Center, Islamabad), Government Officer (Transport Dept.)
Research & Academic Experts	3	Research Associate (IPRI), Senior Economist (NESPAK), Senior Economist (Govt. of Pak),)
Independent Experts/Consultants	4	Sustainability Expert (JK Spinning Mills), Technical Consultant (GGGI/UNEP-CCC), CEO (Hawkeye Engineering), Policy Expert (SDPI)
Total	**15**	

Source: Information synthesized on the basis of interview participants (2025).

3.4.3 Document Review

A review of documents was also conducted to provide additional information and confirmation of the proclamations gained during interviews (Dalglish et al., 2020). This was carried out through the review of various policy, regulatory, and technical documents, which entailed:

- Pakistan Carbon Market Policy Guidelines (2024) – Offered the formal model of creating voluntary and compliance carbon markets in Pakistan.
- National Climate Change Policy (2012, updated 2021) – Described the aim of strategic climate in Pakistan and the institutional mechanisms.

- Pakistan Climate Change Act (2017) – Developed the institutional and legal framework of climate governance in Pakistan.
- Pakistan's Nationally Determined Contributions (NDCs, 2021 update) – Had articulated international obligations of Pakistan in terms of emissions.
- Monitoring, Reporting, and Verification (MRV) Framework documents – Offers technical parts of measurements of emissions and reporting.

International Reports:

- World Bank (State and Trends of Carbon Pricing, 2023/2024).
- UNFCCC reports and decisions on market mechanisms.
- ICAP (International Carbon Action Partnership) reports on global carbon market design.
- UNEP climate finance and carbon trading assessments.
- UNDP reports on capacity building and institutional readiness.

These documents have been chosen since they directly give the institutional, technical and financial preparedness of Pakistan to engage in carbon credit markets. These reports helped in giving a picture of the changing carbon market regime in the country, MRV obligations, policy ambitions, and area commitments in Pakistan. Materials in these papers were systematically coded and thematically examined to pick up patterns, areas of policy priorities, and spaces of implementation holes.

3.4.4 Data Transcription and Translation.

All the interviews were done in a mixed language format and the interviewees would often use both Urdu and English based on their level of comfort. All the Urdu responses were well translated to English to provide uniformity in analysis. To maintain the meaning in the context, the accuracy of the translations was checked by comparing them with the original transcripts. Through this, there was a guarantee that the data had linguistic accuracy and conceptual integrity as it could be subjected to a coherent thematic analysis of all interviews.

3.5 Data formation

The raw interview and documentary data were first prepared systematically to make them clear, accurate and suitable to be coded prior to the commencement of thematic analysis. The steps included:

3.5.1 Transcription

All interviews that had been audio recorded were transcribed verbatim. Where recording was not inconsistent, the specific field notes were elaborated into written transcripts immediately after the interview to ensure that the accuracy is maintained and to minimize the effect of recall bias.

3.5.2 Translation (Urdu to English)

A number of the interviews were conducted in Urdu. The researcher translated them into English; these were done with attention to ensure that the context and the cultural information are maintained and technical terminologies are retained. In cases where there was no direct English equivalent of sector-specific words, the original word form was used with a description.

3.5.3 Anonymization and Error Checking.

All the identifying information including names, organizations and personal information was anonymized in the course of transcription and translation. All the transcripts were then checked twice against the original audio or notes to correct typing mistakes, misunderstandings, and unfinished phrases.

3.5.4 Cleaning and Formatting

The transcripts were organized in a uniform and systematic format in terms of labeling speakers and line spacing. Non-verbal fillers (e.g. um, you know) and repetition were eliminated unless they added some meaning to the response. This action made it easier to read and reduced distractors in the process of coding.

3.5.5 Familiarization

The transcripts and documents were then cleaned and read over and over again by the researcher who made memos and notes in the margins to delve into the content. This step helped identify repetitive concepts and new ideas early, and this helped in the initial coding process.

Such a strict preparation made the set of data credible, consistent and prepared to systematic thematic analysis.

3.6 Data Analysis

The thematic analysis was based on the six steps process of (Braun & Clarke, 2013) , which included familiarization, coding and categorization, and eventual creation of the theme. Based on NVivo coding of interviews and documentary sources, one was able to identify a variety of initial codes. These codes were manifestations of the repetitive problems in policy frameworks, institutional preparedness, technical systems, financial access, knowledge of the stakeholders, governance structures, and impediments to pragmatic implementation.

These codes were grouped into larger themes through the process of iterative categorization. It was an inductive yet deductive process that was informed by the literature but based on empirical evidence. The review demonstrated seven over-themes that summarize the readiness and the bottlenecks of Pakistan in the development of carbon markets. These are presented below.

3.6.1: Step 1: familiarization and Interpretation:

Repeated reading through all the interview transcripts, policy and regulation documents reviewed were done to immerse oneself in data. The first impressions, problem areas, and developing relationships were written down in analytical memos.

3.6.2: Step 2: Initial Coding.

The transcripts were subjected to the open coding line-by-line, whereas policy documents and technical reports were coded with the concepts of significance. A hybrid approach was used:

The research questions and the literature were used to derive deductive codes (e.g. policy effectiveness, institutional preparedness, MRV capacity, financial mechanisms, stakeholder awareness).

Inductive codes came up as a direct result of participant language and documentary support (e.g. fragmented transport systems, the prohibitive cost of verification, the absence of benefit-sharing schemes). All the codes were placed in a codebook with brief definitions and sample quotes.

3.6.3: Step 3: Searching of Categories and Patterns.

Then codes were further classified into general categories. As an example, deficiency in MRV knowledge, absent baselines, and limited human capacity would fall into the category of technical capacity gaps; initial certification expenses, no SME funding would fall under financial barriers. This phase entailed the process of consistent comparison between interviews and documents in order to ensure consistency and fluctuation.

3.6.4: Step 4: Themes Development.

seven main themes were obtained as a result of comparative and refining given below.

1. Policy & Regulatory Framework: the current policies do not give specific guidelines regarding the registry systems, benefit-sharing and sectoral prioritization.
2. Institutional Capacity & Coordination: weak institutional capacity and inadequate organizational preparedness.
3. MRV Systems: no baselines, poor technical knowledge and loopholes in verification systems.
4. Financial Mechanisms / Incentives: upfront costs would be prohibitive and green financing would be limited, which would discourage participation.
5. Stakeholder Awareness and Engagement: policy circles only have limited awareness of carbon market with no outreach to SMEs or the general population.
6. Public-Private Partnerships (PPP): identified as a result of analysis, which sheds light on the importance of collaborative arrangement between the government and the industry to develop carbon market programs.
7. Implementation Challenges: capturing practical barriers such as technical expertise gaps, high upfront costs, regulatory ambiguity, and weak cross-sector coordination.

3.6.5: Step no 5: Themes Reviewing and Refining.

The themes of the candidate were analyzed in terms of internal and external distinctiveness. Overlaps were eliminated by dividing or combining the categories and each theme was well identified with a theme organizing concept. Interview themes have been triangulated with the national policy documents (e.g., Carbon Market Policy Guidelines, NDCs, Climate Change Act, MRV frameworks) and international reports (e.g., World Bank, UNFCCC, ICAP, UNEP), which

means that both local realities and international carbon markets practices have been considered in the findings.

3.6.6: Step no 6: Validating Themes.

Here, it is noteworthy that although the research questions and the literature identified seven themes, another theme; Public-Private Partnerships (PPPs) was also inductively identified during the interviews and documents. It proves how the thematic analysis is flexible enough to apply new issues in comparison to the original structure.

In order to achieve credibility and dependability, a number of validation approaches were used:

1. Triangulation of interviews, national documents and international reports to either verify results or refute them.
2. Cross-checking and re-reading of transcripts in order to stay consistent.
3. Reflexivity by memos on the assumptions of the researcher and how they cause researcher to interpret.
4. The points of saturation came when subsequent transcripts did not yield any substantially new codes.
5. To review the codebook and thematic map, supervisory feedback was being employed, and the boundaries between themes were refined.

This strict procedure resulted in the fact that the analysis shifted the raw transcripts and documents into seven clear themes, which guaranteed the reliability, transparency, and validity of the interpretation of the preparedness of Pakistan to develop the carbon credit market.

3.6.7: Thematic Analysis Process

NVivo software was used to conduct thematic analysis, which helped in systematic coding and the creation of themes. This was done in a thematic method of coding: following the six step process of (Braun & Clarke, 2013).

- Open Coding: Each transcript was read over and again and the important statements identified to come up with the initial codes.
- Categorization: Codes related were combined to form larger categories to identify patterns and relations within the data.

- Theme Development: The categories were narrowed down to broad themes which reflected the objectives of the research directly.

This sequential methodology was the reason why the analysis was both transparent and rigorous, even though NVivo helped organize and access data in order to compare it between interviews and documents.

3.7 Research Locale

The research was carried out in the Islamabad Capital Territory (ICT) in which the majority of the relevant government ministries, regulatory bodies, global organizations and non-governmental organizations are located. Being the center of the national policy and decision-making process, ICT facilitated direct connection to the policymakers and the representatives of the industry, as well as, the experts who participate in the environmental governance and sustainability programs.

The institutions involved in the research are:

- Ministry of Climate Change (MOCC)
- National and sub-national environmental protection agencies, EPAs
- Pakistan Environment Protection Council
- Transport-industry associations and regulators in the sector
- Research institutions and think tanks

Such wide-ranging institutional involvement will permit the research to stand nationwide observation in policy development, preparedness, and execution of the carbon credit market in Pakistan.

3.8 Ethical Considerations

During the research, ethical procedures were observed. Verbal informed consent was obtained during the interviews since the participants were informed about the objective of the study, their rights and the purpose of using the data. Everyone involved was made sure that they took part in the study at their own will and could back out any time without an explanation.

Participant names and other personal information were anonymized and pseudonyms were covered in transcripts and reporting to ensure confidentiality. Tapes and transcripts of the interviews were kept in a safe place only accessible to the researcher. These were done to ensure that the privacy of the participants and the integrity of their data were not compromised during the research process.

3.9 Summary

The chapter defined the research design, sampling, sample features, methods of data collection, review of documents, data analysis, and ethical issues that informed the study. The combination of semi-structured interviews with the systematic document analysis as the methodology allowed achieving the triangulation of findings and generating a profound picture of the readiness of the Pakistani country to develop carbon credit markets. Results of this methodology are given in the next chapter.

CHAPTER 4

Findings and Data Analysis

The chapter gives the results of the thematic analysis of the interview data and documentary sources. Seven themes were identified to show Pakistan readiness and issues in the development of carbon markets they include: (1) Policy and Regulatory Framework, (2) Institutional Capacity, (3) MRV Systems, (4) Financial Mechanisms, (5) Stakeholder Awareness, (6) Public–Private Partnerships (PPPs), and (7) Implementation Challenges. All themes are addressed in the details with supportive interviews quotes and documentary evidence being given with a focus on the contrasting views between the stakeholder groups and sectors.

4.1 Theme 1: Policy and Regulatory Framework.

The Pakistan Carbon Market Policy Guidelines (2024) was continually known as a step in the right direction. The respondents also admitted that the guidelines have laid the foundation of developing the carbon market, but more than once they indicated that there is a lack of compliance with their enforcement and negation with other climate measures. The distance between policy making and the general population was demonstrated when "one government official expressed that the general population in Pakistan is still very unaware of the Carbon Market Policy Guidelines that were introduced in 2024" (Interviewee, Government Official_R1). As in Document Review This is also reflected in the Climate Transparency Report (2023), which notes that Pakistan policy frameworks on climate have inadequate outreach and implementation systems to the population (*Climate Transparency*, 2023)**.**

The stakeholders in the industry were more critical where they pointed out on the challenges of duplication and fragmentation between the federal and provincial governments. According to one representative of industry associations "there is overlaps in federal and provincial roles... there are policies existing but they are not coherent" (Interviewee, Industry Association-R9) The same criticism is present in the submissions of Pakistan Nationally Determined Contribution (NDC)

plans, which promise the state high targets, but emphasizes the low implementation potential (UNFCC NDC, 2021).

The current results can be compared to the NDC of the UNFCCC and the Climate Transparency Report (2023) that acknowledge the policy commitments of Pakistan but highlight the poor correspondence with the domestic enforcement potential. Governmental actors tended to have the story of policy advancement, whereas the private and industry actors emphasized the existence of policy gaps and ambiguous role of institutions.

4.2 Theme 2: Institutional Capacity and coordination.

Institutional readiness was an issue that arose in numerous interviews. There was often poor coordination of ministries with limited technical personnel to handle carbon market mechanisms as depicted by the respondents. One of the respondents in the industry is of the view that "in the industries, nobody can show them how to undertake this project" (Interviewee, Industry Stakeholder-R4), and an NGO participant cited that "fragmentation of institutions is an impediment to progress. Some of the ministries desire to play the role, but there is insufficient coordination" (Interviewee, NGO Representative-R5).

Though the Pakistan Climate Change Act (2017) and the National Climate Change Policy (2021) include institutional arrangements frameworks, the interview evidence indicates that they are not properly implemented. The fact that a Climate Change Authority is planned to be established was touted by government officials as an indicator of innovation, but the absence of technical focal points and institutional accountability was pointed at by the respondents of the private sector and the civil society. This juxtaposition is an indication of disjunction between policy frameworks and working capacity (Khan, 2021; *Pakistan Climate Change Act,* 2017)

4.3 Theme 3: MRV Systems

Lack of standardization of monitoring, reporting, and verification (MRV) system was ranked among the biggest obstacles to carbon market participation. A number of the respondents indicated

"the absence of technical expertise, with one of the technical experts noting that one of the key obstacles is that of technical capacity, because there is little (or I would say none) of expertise or a system of measuring, reporting, and verifying emissions" (Interviewee, Technical Expert-R6). The same issue is supported by reports of the World Bank and UNFCCC as they highlight that the MRV systems are critical to participation in the market yet they have not been thoroughly developed in Pakistan (UNFCC NDC, 2021; *WORLD BANK*, 2020)

The documentary sources such as World Bank and UNFCCC reports affirm that MRV systems form the basis of carbon markets but Pakistan has failed to build a single registry. There are sectoral differences: the industry stakeholders were mainly worried about MRV systems as a compliance challenge associated with the EU Carbon Border Adjustment Mechanism (CBAM), whereas the transport sector respondents were concerned "with the absence of baseline data regarding the development of new projects like electric vehicles and bus rapid transit" (Interviewee, Transport Sector-R2). This is in line with World Bank evaluations and UNFCCC evaluations and in both cases, MRV systems and national registries are necessary to participate in the carbon market and with this, such is not the case in Pakistan (UNFCC NDC, 2021; *WORLD BANK*, 2020)**.**

4.4 Theme 4: Financial Mechanisms / incentives.

The problem of finances was extensively discussed during the interviews. There was a push by the stakeholders that carbon projects can be quite costly upfront and this cannot be afforded by smallest and medium enterprises. A representative of SMEs said that "carbon projects would involve initial investment... small industries will not be able to cover the cost of validation" (Interviewee, SME Representative-R11), and an industry analyst said "larger exporters might be able to cover the cost of EU compliance, but SMEs would not" (Interviewee, Industry ExpertR6).

This issue is reflected in the climate financing reports by the World Bank and the UNEP, which point to the dependence of Pakistan on donor funds and limited local structures (UNEP, 2022; World Bank Group, 2021).The questionnaires to large exporters in industries (set of cement and

textile) with large carbon-intensive facilities are likely to see carbon finance as a chance to stay competitive in the export markets whereas SMEs feel that it is more of an added burden.

Thus, financial access is still a distinction between companies that are globally exposed and smaller local players, which increases inequality in the level of market preparedness.

4.5 Theme 5: Stakeholder Awareness.

One of the most common observations during the interviews was the lack of awareness as related to the carbon markets especially among government and large industries. Admittedly, a government official said that "the majority of citizens do not know about carbon markets" (Interviewee, Government Official-R1), and an industry representative further claimed that "in industries, people only know about the carbon market through a small number of exporters" (Interviewee, Industry Stakeholder-R4).

This has been supported by information on donor funded programs (ADB, World Bank) in that awareness campaigns have been small-scope and small-reach (ADB, 2021; WORLD BANK GROUP, 2021). Government respondents were more inclined to point to the fact that the level of awareness slowly was getting better, but NGOs and other representatives of this group of stakeholders emphasized that the awareness was almost being negligible, mostly among smaller forces and the population.

The intersection of both interview and document evidence highlights the key disjuncture between the discourse of policies and the perception of stakeholders.

4.6 Theme 6: Public Private Partnerships (PPP)

The concept of public-private partnership was identified as one of the possible sources of funding and executing carbon reduction initiatives. A number of respondents gave the example of transport initiatives. One of the experts in the transport sector stated that "transport projects such as Peshawar BRT and Karachi BRT can be worked out as carbon credit projects based on PPP models" (Interviewee, Transport Sector-R8). This can be justified by the development finance

reports that emphasize PPPs as crucial to scaling infrastructure sustainability (ADB, 2021; World Bank Group, 2022).

The PPPs as a tool of attracting investment in low-carbon infrastructure are mentioned in the documentary sources such as reports released by the World Bank and ADB. Government respondents were more likely to discuss PPPs as a way to solve the problem of financing, and the NGOs were interested in the question of the sufficiency of "such like PPPs to engage communities and guarantee fair benefits" (Interviewee, NGO Representative-R5).

This implies that as PPPs look good on paper and in the international good practice, their design in Pakistan should address the issue of governance and equity.

4.7 Theme 7: Implementation challenges.

One of the most cross-cutting aspects that came to mind was, perhaps, the list of practical implementation barriers. The weak sectoral coordination, regulatory ambiguity, and technical capacity issues were always referred to by the respondents. One of the industry stakeholders noted, "preparedness and awareness are low at this point, besides bigger exporters, small industries are even unaware of how to create carbon project" (Interviewee, Industry Stakeholder-R11). On the same note, one respondent on the transport sector observed, "EVs and BRT retrofits could be bundled in clean mobility programs, yet no guidelines on MRV exist" (Interviewee, Transport Sector-R8).

Similar gaps during the implementation are mentioned in documentaries such as the Climate Transparency Report (2023), as well as the NDC updates of Pakistan (climate-transparency, 2018; UNFCCC NDC, 2021). Stakeholders in the industry viewed these challenges in the light of international compliance especially with the EU CBAM, whilst transport sector respondents viewed the lack of baseline data and measurement systems of emerging initiatives.

4.8 Summary of Findings

The seven themes taken together point to structural and feasible features of Pakistan readiness to the carbon market. Formally, there are policy frameworks and institutional structures which on the other hand are weak in terms of institutional capacity and in MRV systems, financing, awareness and implementation which hamper good action.

The contrasts between the sectors are cross-sectoral in nature, where the interest of industry stakeholders is mostly influenced by outside compliance pressure, whereas transport sector actors are made to rely on domestic fragmented initiatives with limited technical support. Combined, the findings indicate that although Pakistan has recorded improvements on paper, it still faces a lot of challenges converting this improvement into operational capacities with regard to carbon markets.

These results can not only present the opportunities and challenges of the Pakistani readiness to carbon markets but the basis of the following chapter, which interprets these findings against the current body of literature, experience of other countries, and policy implications.

Table 5: **Summary of the Thematic Analysis Results**

Theme	Summary of Findings	Illustrative Evidence	Key Contrasts
1. Policy & Regulatory Framework	2024 Guidelines are a milestone that is not strong enough in enforcement and consistency.	Weak awareness (Govt. official); overlapping of functions (Industry).	Govt. emphasizes development; Industry emphasizes disintegration.
2. Institutional Capacity	Structures are present but there is lack of coordination and expertise.	There is no focal persons (Industry); the ministries vie over roles (NGO).	Govt. cite new structures; Others detect poor operationalization.
3. MRV Systems	There is no standardized MRV or registry; there is a lack of expertise.	"None of the real MRV structures therein (Expert); WB/UNFCCC certify gaps.	CBAM concerns by industry; Transport grapples with baseline data.
4. Financial Mechanisms	The cost of starting up is prohibitive to the SMEs; dependency on donor funds.	Validation that cannot be afforded (SME); the exporters survive because of EU requirements.	Big companies find opportunity; SMEs find load.
5. Stakeholder Awareness	Low awareness, above govt. and large exporters.	Unfamiliarity on part of most citizens (Govt.), knowledge limited to exporters (Industry).	Govt. boasts of improvement; NGOs/ private has no or minimal awareness.
6. Public–Private Partnerships (PPPs)	PPP interpreted as a mechanism of financing transport and clean projects.	BRT is an example of PPP (Transport); the WB/ADB support PPPs.	Govt. encourages PPPs; NGOs doubt inclusiveness.
7. Implementation Challenges	Technical loopholes, regulatory ambiguity and poor coordination still exist.	SMEs unprepared (Industry); no MRV EV/BRT (Transport).	Compliance (EU CBAM) is framed by the industry, whereas data gaps are emphasized in the Transport.

This table summarizes the seven themes that were identified in the thematic analysis, with evidence supporting them and differences between stakeholder groups.

Figure 7: **Gaps in Pakistan's Carbon Credit Implementation**

Source: Author's compilation, based on World Bank 2023 & GoP Guidelines 2024

Chapter 5

Discussion and Synthesis of Findings

5.1 Introduction

This chapter will analyze the implications of the results of Chapter 4 and contextualize them within the broader scholarly literature, global practice and the context of Pakistan. Although Chapter 4 explained what was found out in the respondents and documents, this discussion gives the meaning of the findings on how Pakistan is ready to join the carbon markets with a focus on the industry and transport sectors. The identified seven themes are addressed in turn and a synthesis is provided comparing the sectoral preparedness, identifying opportunities and challenges and making implication and a path forward.

5.2 Policy and Regulatory Framework

The results have proved that there has been a deposition of policies in Pakistan that includes the Pakistan Carbon Market Policy Guidelines (2024) and the National Climate Change Policy (2021) (Government Of Pakistan, 2021), and their coherence and implementation are still doubtful. Governmental respondents admitted that citizens do not know much about these policies (Interviewee, Government Official – R1), and industry participants mentioned the overlapping of policies and role ambiguity (Interviewee, Industry Association -R9).

These descriptions are also indicative of the greater literature on policy fragmentation in South Asia (Doda et al., 2023; D. M. B. Khan, 2020), where a decentralized policy on climate governance can be defined by overlapping mandates and non-enforcement. Another problem highlighted in the Climate Transparency Report (2023) was the lack of credibility in the regulatory provisions in Pakistan that will destabilize the establishment of a reliable carbon credit scheme (*Climate Transparency*, 2023; World Bank Group, 2022).

5.2.1: Interpretation: In the absence of more specification of the roles between federal and provincial governments and more effective distribution of guidelines, the policies will be left at an

aspirational level. Policy certainty is needed by the industry to be able to invest and clarity to operations by the transport actors to be able to find clarity on matters such as charging regulations.

5.3 Institutional Capacity and Coordination

Respondents emphasized the fact that there are institutional structures, but there is lack of coordination and technical capacity. One NGO representative stated that ministries are competitive, but not cooperative (Interviewee, NGO Representative -R5), and another industry stakeholder pointed out that there is no technical advice in factories (Interviewee, Industry Stakeholder-R4).

The Climate Change Act (2017) has seen the vision of specific institutions to address the issue of climate change (Khan, 2021; *Pakistan Climate Change Act,* 2017), but the World Bank (2022) has denounced them as poorly resourced and poorly coordinated (World Bank Group, 2022). It is also established in academic sources that fragmented institutions create delays in the approval process and decrease the level of credibility in carbon trading.

5.3.1: Interpretation: Institutional fragmentation did not occur only in Pakistan; it has been documented in the emerging markets (Hemmingsen, 2025b). Nevertheless, the lack of strong inter-ministerial cooperation in Pakistan is a source of inherent impediment. Industry is interested in technical assistance to set up projects, whereas transport actors are required a lead coordinating body in order to weld up municipal transport planning and carbon policy.

5.4 MRV Systems

The lack of working MRV systems was emphasized by the industry and transport respondents. One of the technical professionals attested: there is not much (or I would say not at all) expertise and there is not a system of measuring, reporting, and certifying emissions (Interviewee, Consultant – R6).

This concern is supported with the help of documentary analysis. The absence of a national registry and certified verifiers in Pakistan was noted by the (WORLD BANK GROUP, 2021), and the (UNFCCC, 2023b; UNFCCC NDC, 2021) emphasized that MRV should be strong in order to be recognized internationally.

5.4.1: Interpretation: In the absence of standardized MRV systems, Pakistan will face the threat of credit denial by the global buyers, as it has already happened in early African pilot programs (Sun et al., 2025; Wu et al., 2025). Plant-level baselines and certified auditors are required in the industry, whereas digitalized fleet-level data are required in transport projects (e.g. BRT retrofits, EV fleets). Credibility necessitates sector specific MRV protocols.

5.5 Financial Mechanisms and Incentives

In the financial sector, the obstacle of finances came out strongly in both sectors. The industry stakeholders became aware of the unaffordability of EVs (Interviewee, Industry Stakeholder – R3), transport operators were concerned about the absence of specific funds to convert the fleet (Interviewee, Transport Stakeholder -R8), and SMEs were concerned with the cost of validation (Interviewee, SME Representative –R10). An industry analyst assured that bigger exporters could afford compliance costs in the EU, but SME could not (Interviewee, Consultant – R6).

This is correlated with the experiences in India and Kenya, where the EV and carbon market uptake was slowed down by financial barriers (ADB, 2021; Ahmed, 2023; Butt & Singh, 2023; Sarangi, 2020).Macroeconomic instability also makes the situation worse in Pakistan where long-term investment is discouraged.

5.5.1: Interpretation: The pipeline of carbon credit in Pakistan will be thin without concessional loans, subsidies as well as blended finance mechanisms. The players in the industry should be offered fiscal support and credit guarantees, and the transport sector should be given specific funds to charge the infrastructure and retrofit the fleets.

5.6 Stakeholder Awareness

There were awareness gaps that were raised several times. One of the consultants stated that people do not trust EV reliability (Interviewee, Consultant -R6), and an NGO representative noted that SMEs do not have any information about carbon credits (Interviewee, NGO Representative -R5).

These views replicate the experiences in African markets, where consumer distrust slowed down adoption (Butt & Singh, 2023; Kumar et al., 2024; Liu et al., 2023) (The impediment is awareness

on both demand and supply side: consumers do not trust in EV feasibility and SMEs do not know about carbon credit procedures.

5.6.1: Interpretation: Financial or technical reform is not as important as training and outreach. The industry demanded specific training of developers, whereas transport needs to be educated in terms of the fleet operators and municipal planners.

5.7 Public–Private Partnerships (PPP)

Respondents stressed the use of PPPs as a focus of readiness. According to an NGO representative, it will be impossible to develop sufficient charging infrastructure without the cooperation between the government and private investors (Interviewee, NGO Representative -R5). A respondent in the industry also mentioned that partnerships must have long-term guarantees (Interviewee, Industry Stakeholder -R3).

These views are justified on the international practice: China developed EV infrastructure through PPPs (Khan,Ali, 2020; Sun et al., 2025) (and the UAE applied PPPs to transport development projects (Tanveer et al., 2024; World Bank, 2025b)

5.7.1: Interpretation: PPPs constitute a major chance of Pakistan to assemble finances and technology. However, to be credible, PPP structures have to be open, and risks should be shared as well as contracts implemented.

5.8 Implementation Challenges

There exist gaps in the implementation that cuts across themes. Government officials acknowledged the lack of resources (Interviewee, Government Official -R1), and SMEs expressed a concern of unpreparedness towards CBAM (Interviewee, SME Representative -R10). The respondents in the transport indicated that there are no MRVs of EVs or BRT (Interviewee, Transport Stakeholder -R8).

These issues are reflected in the World Bank (2022) and Climate Transparency Report (2023) which highlight poor enforcement by Pakistan and technical weakness (Aleksandra, 2020; *Climate Transparency*, 2023; World Bank Group, 2022).

5.8.1: Interpretation: The problems of implementation in Pakistan are systemic. Policy ambition will not be turned into marketable carbon credits unless the shortcomings of governance, finance, MRV, and awareness are tackled concurrently with one another.

5.9 Sectoral Readiness: Industry vs. Transport

Themes pattern Synthesizing reveals different readiness patterns.

Industry (R3, R4, R9, R11): In a better position to work with international frameworks of compliance (e.g., EU CBAM) and with project-level carbon crediting. But the policy uncertainty, no concessional finance, reliance on imports as well as MRV gaps limit development (European Commission, 2023; ICAP, 2023).

Transport (R2, R8): The key to emission reduction, but limited by preparative planning, lack of MRV and operator cynicism. Preparedness is confined to pilot projects like retrofitting of BRT and municipal EV fleet (Aleksandra, 2020; Khan & Ali, 2020; Rasool et al., 2019).

5.9.1: Interpretation: Although both sectors are willing, neither of them is structurally prepared to do much carbon credit production.

5.10 Opportunities and Challenges

5.10.1: Opportunities

- Possibility to create quantifiable cuts (UNFCCC, 2023a, 2023b, 2024; UNFCCC NDC, 2021).

Article 6 markets can allow Pakistan to take part in the efficient upgrades of the industry and transport interventions (EV fleets, BRT retrofits) and get verifiable credits.

- Climate finance access (UNDP, 2022b; *WORLD BANK*, 2020; World Bank Group, 2021, 2022).

The mechanisms of article 6 provide new avenues of foreign investment and result based finance, which is essential in the face of fiscal limitations in Pakistan.

- Public-Private Partnerships (Tanveer et al., 2024; World Bank Group, 2025).

PPPs have the ability to organize capital and risk-share EV infrastructure and industrial retrofits, and respondents (R5, R3) note that they are at the center of this response.

- Creation of jobs by the production of EV (Butt & Singh, 2023; Kumar et al., 2024)

The industry members mentioned that scaling the EV production and batteries would provide employment, reduce import expenses, and integrate Pakistan into the clean technology manufacturers and distributors (R3, R9).

5.10.2: Challenges:

- Poor enforcement, and policy fragmentation (Doda et al., 2023; D. M. B. Khan, 2020)

There are guidelines, but they have overlapping requirements and lax enforcement (R1, R9), which makes them less credible and confident to investors.

- Half-baked MRV systems (UNFCCC NDC, 2021; WORLD BANK GROUP, 2021).

International recognition of credits is not possible due to lack of baseline data, registries and verifiers (R6, R8).

- Expensive nature and inadequate finances (ADB, 2021; Sarangi, 2020).

SMEs (R11) and operators (R8) have difficulties with validation and initial expenses and smaller participants are left out.

- Poor awareness and cynicism (Butt & Singh, 2023; Liu et al., 2023).

Low adoption due to skepticism on EVs and low awareness of carbon markets (R5, R6) inhibits adoption with favorable policies.

- Reliance of imports (Ahmed, 2023).

Imported EVs and batteries (R3) increase the expenses and slow down the scaling without producing them locally.

5.11 Policy Implications and Way Forward

1. Form a central authority and registry of carbon markets in order to unify mandates.
2. Formulate industry-related MRV, invest in computerized tracking.
3. Offer industry concessional loans and subsidies, and special funds to transport infrastructure.
4. Pilot projects (local EV fleets, industrial retrofits) to show that it is possible.
5. Conduct awareness and capacity building initiatives on SMEs, fleet operators and project developers.
6. Establish systematic PPP systems where there are well-organized contracts and risk-sharing systems.
7. Match the systems of the Pakistani system with the international standards (Article 6, IC-VCM) in order to make the credit tradable.

In this chapter, Chapter 5 findings have been interpreted putting them in the context of the larger body of literature and global experiences. The analysis indicates that the industry and transport industry in Pakistan has realized the potential of carbon markets and understand the value of seeking project on emission reduction. The opportunities are in the form of quantifiable reduction of emissions, the potential to attract climate finance with the help of Article 6 arrangements, employment because of the production of EVs, and the recruitment of the use of the public-private cooperation in expanding the infrastructure. These opportunities are limited however by structural issues that are persistent. Poor governance and fragmentation of policies discourages investors, the lack of strong MRV systems hampers the internationalization of credits, and the inability to get finances forces SMEs and transport operators to enter. Moreover, low awareness and distrust toward new technologies slows the adoption and makes the market less prepared. Provided that such holes in the system of governance, technical systems, funding, and awareness are not properly sealed, Pakistan will not be able to achieve its goal of creating a credible, scalable, and revenue-

generating carbon credit market. This understanding emphasizes the fact that preparedness is not merely a matter of paper policies, but about the match between institutions, finance and capacity with international standards.

The lessons learned in these insights lead to Chapter 6, presenting the summary of the most important contributions of this study, its limitation and recommended future research directions.

CHAPTER 6

Conclusion

6.1 Summary of Key Findings

This paper aimed to discuss the prospects of Pakistan development of carbon credit market with reference to transport and industry. Thematic analysis of the interview material and documentary evidence revealed seven themes, which include policy and regulatory framework, institutional capacity and coordination, MRV systems, financial mechanisms, stakeholder awareness, public-private partnerships, and implementation issues.

The results indicated that Pakistan has already undertaken significant actions with regard to policy formulation, including the Pakistan Carbon Market Policy Guidelines (2024) and the National Climate Change Policy (2021). These policies are however disjointed with lax enforcement and dissemination and industry and transport stakeholders have not been certain of their roles. There was also institutional fragmentation whereby overlapping mandates and scanty technical capacity delayed the approval processes and decreased market credibility.

The most notable readiness gap identified was always technical barriers particularly the lack of a strong Monitoring, Reporting, and Verification (MRV) system. Pakistan will be locked out of the international carbon markets unless it has standardized protocols, accredited verifiers, and has reliable data systems.

Economic limitations were also a major issue. Participation is limited by high start-up costs, lack of concessional loans and low capability of the SMEs and transport operators to cover the cost of validation. The other major reasons mentioned by the respondents were the poor stakeholder awareness, as there was a high level of skepticism towards EVs and low level of carbon credit process knowledge, especially among the SMEs.

Regardless of such obstacles, there are also opportunities in the research. The two sectors identify the opportunities in quantifiable emission cuts, global climate finance, and government-corporate cooperation. The industry stakeholders emphasized the prospects of creating jobs by producing EVs, but the actors in the transport sector mentioned BRT retrofits and EV fleets as potential carbon initiatives.

On the whole, the paper comes to the conclusion that Pakistan has already come a long way in its understanding of the significance of carbon markets, but it is still not in a position to fully utilize its potential and enjoy the benefits due to the lack of institutional, technical and financial preparedness.

6.1.1 Achievement of Research Objectives

This study was able to fulfill all of its stipulated purposes in a qualitative and multi-source study. The first aim; to determine the potential and challenges of the carbon credit market of Pakistan, specifically in industrial and transport industry was fulfilled by conducting semi-structured interviews with the key stakeholders and successively followed up by thematic analysis that demonstrated the institutional weaknesses as well as new opportunities. The second goal, which was to assess the effectiveness of the Carbon Market Policy Guidelines (2024), was achieved through the critical review of the policy documents in question and the subsequent triangulation of the insights with the stakeholder view on the issue and the experience of other countries in implementing a similar policy, the EU ETS and the PAT Scheme in India. Lastly, the third aim to provide policy recommendations was achieved, as empirical findings supported by synthesizing results into a working guidance on how to build legal frameworks, create sector MRV systems, build capacity, and work together with financial and private entities. Taken together, the results of these studies can affirm that the aims of the research were fully realized and evaluated.

6.2 Contributions of the Study

The study contributes to the body of scholarly literature and policy discourse in a number of ways:

6.2.1: Sector-specific knowledge: Although the industry is better placed to follow the global compliance frameworks, according to the comparison of the industry and transport sectors, the latter are limited to small-scale pilots.

6.2.2: Combination of several views: The research combines the opinions of government representatives, industry representatives, NGOs, consultants, and SMEs, documentary data. This three-fold methodology will increase validity and will help achieve a more complex picture of carbon market readiness.

6.2.3: Determination of readiness gaps: The research contributes to the literature by outlining the key weaknesses of Pakistan such as fragmented governance, incomplete MRV systems, deficiency of finance and low awareness and relating them to the challenges encountered by other developing nations.

6.2.4: Policy relevance: The policy findings can be used by policy makers by giving evidence-based policy recommendations such as the establishment of a centralized carbon market authority, sector-specific MRV protocols and specific financial instruments. The insights can be used in the national strategies as well as the involvement of the Pakistani nation in the international negotiations within the frames of Article 6 of the Paris Agreement.

6.3 Limitations

Although the research provides some useful results, certain weaknesses need to be mentioned.

6.3.1: Sample size and scope: The interviewees were diverse in number, but rather limited. A wider group of respondents, especially provincial governments and foreign purchasers of carbon credits, would be able to offer more in-depth information.

6.3.2: Sector concentration: The paper has focused on the industry and transport sectors which are sources of critical but not the only emissions. There are other industries like agriculture and waste management that have potential of carbon market projects though this research was not within the scope of this study.

7.3.3: Time and data limitations: The review was based on documents and personal experience of the respondents. This was because of the lack of specific quantitative information (e.g., emission baselines) which could have been used in order to model the potential of Pakistan to acquire specific carbon credit.

6.4 Future Research Directions and Ways Forward

This study can be enhanced in the future through a number of ways.

- Sectoral extent coverage: Agriculture, forestry, and waste management should be covered to present a more detailed view of the general preparedness of the Pakistani carbon market.

- Quantitative modeling: the baselines of emissions and financial models of costs and benefits could be developed to enable more accurate estimation of the potential carbon credit and economic benefits in Pakistan.
- Comparative studies: Comparisons with other countries of the South Asian region, especially India and Bangladesh, would help learn a lot and understand the best practice.
- Longitudinal study: It would be interesting to monitor the policy implementation and the development of the market through time to understand whether the current reforms can convert into the credible and tradable credits.

6.4.1: Way Forward:

- To make Pakistan have a credible carbon credit market, some urgent measures are required:
- Enhance governance through forming a centralized power and defining institutional mandates.
- Invest in MRV systems whose protocols are sector specific.
- Offer concessional finance, especially to the SMEs and transport operators.
- Create awareness to the stakeholders by training, campaigns, and pilot demonstration projects.
- Use PPPs in accelerating infrastructure building and technology transfer.

6.5 Conclusion

To sum up, the paper has revealed that Pakistan is at crossroads in its endeavor of a carbon market. The prospects are apparent: the potential of reduction of emissions, international climate finance availability, and co-benefits, including industrial growth and creation of jobs. However, the obstacles, such as poor governance, the lack of MRV systems, financial limitations, and the lack of awareness are also burning.

There will be no chance of Pakistan shifting its policy wishes into a viable carbon credit market unless such barriers are dealt with systematically. Nevertheless, when the governance is undertaken seriously to reform, institutional capacity-building and financial innovation, then Pakistan can end up being a serious player in the global carbon markets and transform climate challenges into sustainable development.

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Appendices

Appendix A: List of Respondents

This study was carried out by conducting 15 interviews. To preserve the privacy of interviewees, they have been categorized into 10 stakeholder groups (R1-R10). In other instances, there is multiple representation of a respondent under one code (such as more than one SME representative under R10, or more than one industry stakeholder under R3/R4). This method is anonymous and represents the variety of views.

R1- Governmental Official (Climate Change Ministry).

R2 Government official (Transport Department).

R3 - Industry Stakeholder (Automotive).

R4 - Energy/ Manufacturing Industry Stakeholder.

R5 NGO Representative (Climate/Policy).

R6 – Consultant/Technical Expert.

R7 – Academic / Research Expert

R8. Transport Stakeholder / Operator (Public/Private Fleets, BRT)

R9- Industry Association Representative.

R10 – SME Representative

Appendix B: Codebook

Theme	Sub-theme (s)	Definition	Deductive / Inductive	Illustrative Quote (with Code)
Policy and Regulatory Framework	Policy gaps, weak enforcement	Means the transparency and implementation of the carbon market policies in Pakistan.	Deductive	"Policies are there but they are not coherent." (Interviewee, Industry Association – R9)
Institutional Capacity and Coordination	Overlaps, lack of expertise	Examines the way institutions coordinate and give technical support.	Deductive	"Division of institutions is a burden to development." (Interviewee, NGO Representative – R5)
MRV Systems	No registry, no verifiers, weak data	Access to systems to measure, report and verify the emissions.	Deductive	"Little or no MRV expertise exists." (Interviewee, Consultant – R6)
Financial Mechanisms and Incentives	High costs, no concessional finance	Availability of cheap capital on carbon initiatives.	Deductive	"The small industries are unable to pay validation." (Interviewee, SME Representative – R10)
Stakeholder Awareness	Low awareness, skepticism	Carbon market knowledge and understanding.	Inductive	"Carbon credits are not known to SMEs." (Interviewee, NGO Representative – R5)

Public–Private Partnerships (PPP)	Joint efforts for EVs, BRT, and projects	Government and private investors collaboration.	Deductive	"Infrastructure charging requires cooperation." (Interviewee, NGO Representative – R5)
Implementation Challenges	Weak enforcement, low readiness	Barriers to turning policy into practice.	Inductive	"SMEs have no idea of developing carbon projects." (Interviewee, SME Representative – R10)

Appendix C: Documents Reviewed

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